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FORESTRY

FEBRUARY 1952

SOCIETY OF AMERICAN FORESTERS 1900

Volume 50
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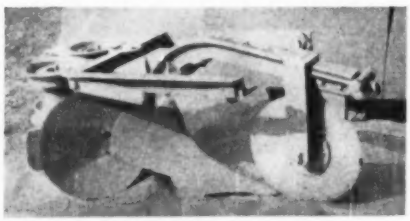

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The 51st Annual Meeting

With a registered attendance of 1113, the annual meeting of the Society of American Foresters held in Biloxi, Miss., December 12-15, was one of the largest gatherings of professional foresters ever held, anywhere.

The theme of the general session was "Southern Forests—Past, Present, and Future." President Charles F. Evans opened the first general session on December 13 with greetings and a welcome to all those in attendance. J. Herbert Stone presided. I. F. Eldredge led off with the first paper, "Southern Forests — Then and Now." Paul M. Garrison told of "Building and Industry on Cutover Lands." Peter Watzek discussed "Integrating Production and Utilization." C. D. Dosker emphasized the "Importance of Hardwood Utilization Trends in Southern Forestry."

Arthur W. Nelson, Jr. served as chairman for the second general session on December 15. Speakers and their topics were "Harnessing Farm Woodlands and Southern Industry" by E. T. Hawes; "The Use of Fire in Southern Pine Management" by A. D. Folweiler; and "The South's Approach to Regional Education in Forestry" by William J. McGlothlin. Two papers were given on the subject "Impact of the National Emergency on American Forestry." Frank Heyward, Jr. discussed "The Impact on Production" and Charles L. Tebb "The Impact on Forest Resource." The concluding paper on the program was given by William A. Duerr, "The Forest Future of the South."

Society Affairs Session

A highlight of the Society Affairs Session was the presentation to President Evans of a gavel made of elm wood, from a tree which George Washington himself had planted at Mount Vernon. The presentation, in behalf of the Puget Sound and Columbia River Sections, was made by William D. Hagenstein.

The annual reports of the president, C. F. Evans, the executive secretary, Henry Clepper, and the editor, Albert G. Hall, were given at this session. They are published in the Society Affairs department of this issue.

The remainder of the period was devoted to a panel discussion of qualifications for Junior membership. The topic was "Approved Curricula for Society Membership."

R. E. McArdle, chairman of the Council Committee on Membership, acted as moderator. Participating on the panel were James S. Bethel, F. H. Kaufert, Myron Krueger, and Carl Rishell. Open forum discussion followed.

Preceding this session, there was a joint meeting of the Council and the Section delegates. A special report of this meeting appears in the Society Affairs section.

Division Meetings

Each of the Society's 11 subject Divisions held a meeting. The Divisions of Education, Silviculture, and Forest Management held full-day meetings (morning and afternoon). The other Divisions—Public Relations, Forest Economics, Forest Recreation, Range Management, Watershed Management, and Forest-Wildlife Management held half-day sessions. The Divisions of Forest Products and Private Forestry jointly held a full-day session.

In all, 64 technical papers were presented at these sessions. Most of these papers will be published in the JOURNAL during 1952.

Reports of the Division meetings will be found in the Society Affairs section of this issue.

The Society Dinner

Preceding the annual dinner, the Society's members and their ladies

Participants in first general session: *l* to r. Peter Watzek, Paul M. Garrison, J. Herbert Stone, I. F. Eldridge, Charles F. Evans, C. D. Dosker.

Panel on "Approved Curricula for Society Membership": *l* to *r*: Carl Rishell, James S. Bethel, R. E. McArdle, Myron Krueger, F. H. Kaufert.

enjoyed the hospitality of a social hour provided through the kindness of the Southern Pine Association.

This meeting marked a departure from the customary Society dinner characterized by speeches. In keeping with the informality of the occasion, a seafood jamboree was held, a function for which the Buena Vista Hotel is well known. The number of persons served at this dinner (875) was the largest in the Society's history.

Charles H. Flory served as toastmaster. The program featured a girls' octet from the Piney Woods Country Life School near Jackson, Miss. They sang plantation songs and spirituals of the old South. Justin Wilson, a folklorist and humorist of Shreveport, La., told stories in Cajun dialect.

Field Trips

Three optional field trips were scheduled. The first was a pre-meeting trip to Bogalusa, La. to inspect the plantations and forestry operations of the Gaylord Container Corporation. This, one of the interesting forestry showplaces in the South, attracted a group of more than 200 foresters.

Luncheon was served in the field by the host company. The excursion was under the supervision of Paul M. Garrison, chief forester for the company, and of T. E. Bercaw, his assistant.

A second field trip of a half-day duration was held on December 12 and repeated on December 15. These were local trips to private and public forestry operations nearby Biloxi, featuring an exhibit and demonstration of fire control equipment.

Ladies Activities

Some two hundred ladies were in attendance at the meeting. They assembled for a get-acquainted coffee hour on the morning of the first day, and in the afternoon many played bridge and canasta.

On December 14 they made a tour of the Gulf Coast with a stop for luncheon at Ossian Hall in Pass Christian, a historic southern mansion maintained in antebellum style.

Hospitality Room

Through the hospitality of the Gulf States Section, there was open house in one of the large rooms of the Buena Vista Hotel for two days during the meeting. This room was in charge of A. K. Dexter and featured free shrimp and refreshments for all who cared to partake of them. It was one of the big hits of the meeting and served splendidly to help foresters and their wives get acquainted.

Related Meetings

Most of the schools of forestry were represented by alumni reunions. The Council of Forestry School Executives met following the regular meeting.

In addition, there were meetings of the Association of Consulting Foresters, the National Council of Extension Foresters, the International Society of Tropical Foresters, and the Executive Committee of the Association of State Foresters.

So many members served on committees for the meeting and otherwise contributed to its success that it is impossible to list them all. Charles A. Connaughton acted as general chairman. To all who assisted him or participated in any way, the Council of the Society extends heartfelt thanks.

William D. Hagenstein, in behalf of Puget Sound and Columbia River Sections, presents gavel to President Charles F. Evans.

Structure, Growth, and Drain in Balanced Uneven-Aged Forests[1]

H. Arthur Meyer
Professor of forestry, The Pennsylvania State College, State College.

A BALANCED UNEVEN-AGED FOREST is one in which the current growth can be removed annually or periodically while maintaining at the same time the structure and initial volume of the forest. It is, or may be considered, a forest with a normal growing stock, capable of producing a sustained yield. In a balanced virgin forest, the current growth is offset by current mortality, and the existing balance between growth and mortality makes it possible for such a forest to perpetuate itself indefinitely. From experimental investigations on balanced managed and certain undisturbed virgin forests, considerable knowledge has been gained concerning the diameter distribution in these forests. Experimental work has shown that the diameter distribution is of the inversed J-shaped form, which when plotted on semi-logarithmic paper yields a straight line (*2, 3, 5*). Actual examples of balanced diameter distributions are shown in Figure 1.

Balanced forests with a rather well defined diameter distribution are encountered not only in well managed forests and in virgin forests, but in any large forest area which contains a reasonable amount of pole timber and light and heavy saw timber, such as is the case with the forests of an entire county or state. In all the examples shown in Figure 1, a curve of the exponential type fits the actual data obtained in the respective timber surveys with a high degree of precision.

This paper presents a new method for calculating the percentage of number of trees or their volume which may be cut in each diameter class (or which may die in each diameter class) while the initial structure of the forest is being maintained. By stating the purpose of this paper in this fashion, it is not to be implied that in forest management the cuttings should be carried out so as actually to maintain a given forest structure. However, if we know how much to cut in each diameter class in order to maintain a given structure, we automatically know how much to cut in order to change a given diameter distribution according to our own choosing. In statewide timber surveys, this knowledge will be useful for determining the actual and the desired drain on the forests of a region. As illustrated later, this will help in state and national planning, which has as its objective the maintenance and rebuilding of the timber resources of the area.

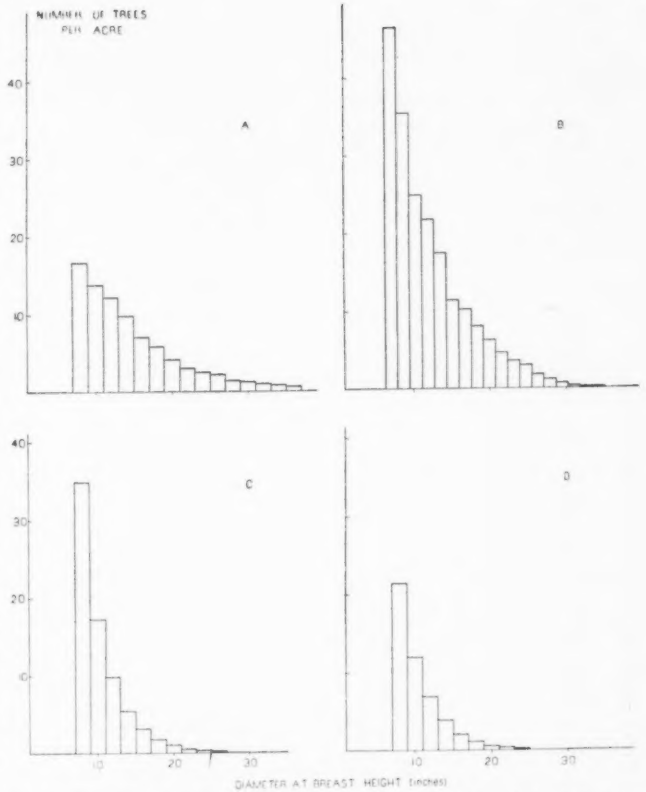

FIG. 1.—Balanced diameter distributions: *A*. Virgin beech-birch-maple-hemlock forest in northern Pennsylvania; *B*. Selection forest, Switzerland; *C*. New Hampshire timber survey data; *D*. timber survey of softwood type, Scott County, Miss.

Diameter Distribution in Balanced Uneven-aged Forests

The diameter distribution in any large forest area tends towards the inversed J-shaped form as illustrated in Figure 1. In a well stocked managed forest with a more or less balanced structure, there is relatively more medium sized and large timber than on a relatively depleted forest area. A virgin forest may show a maximum accumulation of volume, even though the diameter distribution of trees re-

[1]Authorized for publication on May 9, 1951, as Paper No. 1668 in the JOURNAL Series of the Pennsylvania Agricultural Experiment Station.

mains balanced in the sense that the given structure can be maintained. Somewhere between the extremes of a well stocked virgin forest and a somewhat understocked forest area lies the desired optimum stocking sought in forest management.

The various structural types shown in Figure 1 have one common characteristic: Each of the diameter distributions shown can be described by an exponential function of the form

$$YdX = k \cdot e^{-aX} dX$$

where

YdX = number of trees in a narrow diameter interval dX
X = diameter at breast height
e = base of natural logarithms
k,a = constants which characterize a certain structure

It can be shown that the number of trees in successive diameter classes of a diameter distribution of this type represents a *geometric series*. That means, the quotient q between number of trees in successive diameter classes is constant. This fact, originally discovered in 1898 by the French forester de Liocourt, is often known or referred to as the *law of de Liocourt*. Numerical values of the quotient q are found to fluctuate over a wide range. The data listed in Table 1 show values of q varying from 1.13 to 1.56. Values of q up to 2.0 and larger are found to be associated with balanced diameter distributions of relatively understocked areas. With the application of 2-inch diameter classes, the relationship between q and the constant a of the exponential distribution function is given by the equation $q = e^{2a}$.

In order to decide whether a given structure comforms sufficiently to the form of the curve characterized by this distribution function, it is well to plot number of trees in terms of diameter at breast height on semi-logarithmic paper. The plotted points should then roughly follow a straight line as shown in Figure 2 for the data of the forest survey of New Hampshire. The constant a designates the slope of the line, while k indicates relative stand density, that is, for a given value of a, higher or lower values of k indicate higher or lower stand density.[2] The two constants a and k are closely correlated with each other. Since a high value of a means a rapid decrease in number of trees for increasing diameters, it is obvious that with relatively more trees in the lower diameter classes, the number of trees per acre can be much larger than in a forest with a relatively large amount of heavy timber; hence, a large value of a will be associated with a large value of k. It is found, however, that for a certain forest type, the value of k for a given value of a can still vary considerably, indicating different degrees of stocking or stand density. Variations in stocking may reflect influences of site or quality of management. Corresponding values of a and k for a large number of balanced forest structures investigated over a period of twenty years are shown in Table 1.

It is necessary to point out that not all stem distributions of uneven-aged forests follow the law of the distribution function given above. Certain significant deviations, as discovered, for example, in virgin ponderosa pine forests of Arizona can be explained by the predominance of certain age classes, caused by past large fires or calamities which are followed by abundant natural regeneration of a major portion of the forest. Excess of trees in the smallest diameter class may be due to a lack of cutting in these unmerchantable size classes.

Knowing the range of corresponding values of a and k for a given forest type, it is possible to calculate the stem distribution of a series of gradually differing structural types. An investigation of this kind, carried out for the beech-birch-maple-hemlock forests of northern Pennsylvania, indicates that the desired volume on the Allegheny National Forest, somewhat changing according to location and site, should be between 2,000 and 4,000 cubic feet per acre, with a percentage distribution by size classes as indicated in Table 3. If the production of saw timber is the main object of management, the desired growing stock should lie between 3,000 and 4,000 cubic feet per acre; if the emphasis is on the production of pulpwood, a growing

TABLE 1.—CONSTANTS a AND k OF THE DIAMETER DISTRIBUTION FUNCTION $YdX = k \cdot e^{-aX} \cdot dX$ AND CONSTANT q, CHARACTERIZING THE STRUCTURE OF BALANCED UNEVEN-AGED FORESTS

Tract No.[1]	Area	a	k	q
	Acres			
1	12.2	0.143	33	1.33
2	14.4	.114	24	1.25
3	10.8	.072	12	1.15
4	9.4	.175	53	1.42
5	5.0	.088	18	1.19
6	11.7	.145	41	1.34
7	17.6	.145	47	1.34
8	13.5	.140	40	1.32
9	22.1	.133	28	1.28
10	9.7	.180	41	1.43
11	34.6	.071	11	1.15
12	7.4	.079	17	1.17
13	36.9	.073	10	1.16
14	21.5	.085	10	1.19
15	15.3	.135	23	1.31
16	32.3	.116	19	1.26
17	12.5	.150	30	1.35
18	11.2	.137	27	1.32
19	15.4	.131	31	1.30
20	14.6	.092	15	1.20
21	10.6	.102	18	1.23
22	14.3	.083	12	1.18
23	21.4	.128	26	1.29
24	9.2	.103	19	1.23
25	24.2	.134	31	1.30
26	11.4	.118	20	1.26
27	24.7	.060	7	1.13
28	24.7	.117	22	1.26
29	19.8	.106	21	1.24
30	22.2	.126	21	1.29
31	22.2	.102	18	1.22
32	17.3	.089	13	1.19
33	9.9	.082	17	1.18
34	39.2	.147	56	1.34
35	56.1	.160	65	1.38
36	18.5	.160	72	1.38
37	37.7	.201	136	1.49
38	17.8	.221	137	1.55
39	29.4	.147	45	1.34
40	28.4	.102	23	1.23
41	42.0	.163	66	1.38
42	71.8	.163	76	1.38
43	97.9	.163	70	1.38
44	61.1	.150	59	1.35
45	19.8	.221	152	1.56
46	20.7	.137	41	1.37
47	14.0	.147	57	1.34
48	41.5	.185	104	1.45
49	54.0	.163	72	1.38
50	27.5	.170	75	1.40

[1]Tract No. 1-26: Virgin beech-birch-maple-hemlock forests, northern Pennsylvania.
Tract No. 27-33: Virgin pine-fir forest, Sierra de Atlamxac, Puebla, Mexico.
Tract No. 34-50: Spruce-fir-beech selection forests, Emmenthal, Switzerland.

[2]The calculation of a and k (or of q) for a given diameter distribution is fully explained by Meyer and Stevenson (*5*, pp. 470-471). It is usually sufficient to plot number of trees by diameter classes on semi-logarithmic paper, fit by free hand a straight line to the data and determine q as the quotient of number of trees in successive diameter class as read from the line fitted to the data.

TABLE 2.—GROSS VOLUME INCREASE IN PERCENT OF VOLUME BY DIAMETER CLASSES IN BALANCED UNEVEN-AGED FORESTS FOR DIFFERENT VALUES OF AVERAGE ANNUAL DIAMETER GROWTH I AND DIFFERENT VALUES OF q (q = QUOTIENT OF NUMBER OF TREES IN SUCCESSIVE 2-INCH DIAMETER CLASSES)

Quotient between number of trees in successive 2-inch diameter classes	Average annual diameter growth I in inches													
q	0.04	0.06	0.08	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30
	Increase percent = $(q^{1/2}-1)$ 100													
1.20	0.4	0.5	0.7	0.9	1.1	1.3	1.5	1.7	1.8	2.0	2.2	2.4	2.6	2.8
1.22	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0
1.24	0.4	0.6	0.9	1.1	1.3	1.5	1.7	2.0	2.2	2.4	2.6	2.8	3.1	3.3
1.26	0.5	0.7	0.9	1.2	1.4	1.6	1.9	2.1	2.3	2.6	2.8	3.1	3.3	3.5
1.28	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.2	2.5	2.8	3.0	3.3	3.5	3.8
1.30	0.5	0.8	1.1	1.3	1.6	1.9	2.1	2.4	2.7	2.9	3.2	3.5	3.7	4.0
1.32	0.6	0.8	1.1	1.4	1.7	2.0	2.2	2.5	2.8	3.1	3.4	3.7	4.0	4.3
1.34	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.2	4.5
1.36	0.6	0.9	1.2	1.5	1.9	2.2	2.5	2.8	3.1	3.4	3.8	4.1	4.4	4.7
1.38	0.6	1.0	1.3	1.6	2.0	2.3	2.6	2.9	3.3	3.6	3.9	4.3	4.6	4.9
1.40	0.7	1.0	1.4	1.7	2.0	2.4	2.7	3.1	3.4	3.8	4.1	4.5	4.8	5.2
1.42	0.7	1.1	1.4	1.8	2.1	2.5	2.8	3.2	3.6	3.9	4.3	4.7	5.0	5.4
1.44	0.7	1.1	1.5	1.8	2.2	2.6	3.0	3.3	3.7	4.1	4.5	4.9	5.2	5.6
1.46	0.8	1.1	1.5	1.9	2.3	2.7	5.1	3.5	3.9	4.3	4.6	5.0	5.4	5.8
1.48	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.6	6.1
1.50	0.8	1.2	1.6	2.0	2.5	2.9	3.3	3.7	4.1	4.6	5.0	5.4	5.8	6.3
1.52	0.8	1.3	1.7	2.1	2.5	3.0	3.4	3.8	4.3	4.7	5.2	5.6	6.0	6.5
1.54	0.9	1.3	1.7	2.2	2.6	3.1	3.5	4.0	4.4	4.9	5.3	5.8	6.2	6.7
1.56	0.9	1.3	1.8	2.2	2.7	3.2	3.6	4.1	4.5	5.0	5.5	6.0	6.4	6.9
1.58	0.9	1.4	1.8	2.3	2.8	3.3	3.7	4.2	4.7	5.2	5.6	6.1	6.6	7.1
1.60	0.9	1.4	1.9	2.4	2.9	3.3	3.8	4.3	4.8	5.3	5.8	6.3	6.8	7.3
1.62	1.0	1.5	1.9	2.4	2.9	3.4	3.9	4.4	4.9	5.5	6.0	6.5	7.0	7.5
1.64	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.6	5.1	5.6	6.1	6.6	7.2	7.7
1.66	1.0	1.5	2.0	2.6	3.1	3.6	4.1	4.7	5.2	5.7	6.3	6.8	7.4	7.9
1.68	1.0	1.6	2.1	2.6	3.2	3.7	4.2	4.8	5.3	5.9	6.4	7.0	7.5	8.1
1.70	1.1	1.6	2.1	2.7	3.2	3.8	4.3	4.9	5.4	6.0	6.6	7.1	7.7	8.3
1.72	1.1	1.6	2.2	2.7	3.3	3.9	4.4	5.0	5.6	6.1	6.7	7.3	7.9	8.5
1.74	1.1	1.7	2.2	2.8	3.4	4.0	4.5	5.1	5.7	6.3	6.9	7.5	8.1	8.7
1.76	1.1	1.7	2.3	2.9	3.5	4.0	4.6	5.2	5.8	6.4	7.0	7.6	8.2	8.8
1.78	1.2	1.7	2.3	2.9	3.5	4.1	4.7	5.3	5.9	6.5	7.2	7.8	8.4	9.0
1.80	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.1	6.7	7.3	7.9	8.6	9.2
1.82	1.2	1.8	2.4	3.0	3.7	4.3	4.9	5.5	6.2	6.8	7.5	8.1	8.7	9.4
1.84	1.2	1.8	2.5	3.1	3.7	4.4	5.0	5.6	6.3	6.9	7.6	8.2	8.9	9.6
1.86	1.2	1.9	2.5	3.2	3.8	4.4	5.1	5.7	6.4	7.1	7.7	8.4	9.1	9.8
1.88	1.3	1.9	2.6	3.2	3.9	4.5	5.2	5.8	6.5	7.2	7.9	8.6	9.2	9.9
1.90	1.3	1.9	2.6	3.3	3.9	4.6	5.3	5.9	6.6	7.3	8.0	8.7	9.4	10.1
1.92	1.3	2.0	2.6	3.3	4.0	4.7	5.4	6.0	6.7	7.4	8.1	8.9	9.6	10.3
1.94	1.3	2.0	2.7	3.4	4.1	4.7	5.4	6.1	6.9	7.6	8.3	9.0	9.7	10.5
1.96	1.4	2.0	2.7	3.4	4.1	4.8	5.5	6.2	7.0	7.7	8.4	9.1	9.9	10.6
1.98	1.4	2.1	2.8	3.5	4.2	4.9	5.6	6.3	7.1	7.8	8.5	9.3	10.0	10.8

stock of 2,000 to 3,000 cubic feet will be adequate.[3]

Calculation of Gross Volume Increase by Diameter Classes

Because of the annual diameter growth of the trees, a given balanced diameter distribution changes from one year to the next. Through mortality or cuttings the original distributions may be automatically restored. If no trees die and no trees are cut, a given distribution would change as indicated in Figure 3. In each diameter class the distribution curve would move to the right by an amount equal to the average diameter growth of each diameter class. The number of trees by diameter classes would therefore increase in all diameters and in order to restore the original distribution, the equivalent in number of trees to the annual or periodic increase shown by the shaded area in Figure 3 would have to be removed each year or each period. For a certain average diameter growth, I, this increase in number of trees can easily be calculated for each diameter class. If expressed in percent of the original number of trees in that diameter class, we obtain the percentage of gross volume increase which is the same as the cutting percent, provided the original diameter distribution is to be restored. A surprisingly simple result for this percentage volume increase is obtained.

For the sake of generality, let us assume that the average diameter growth, I, by diameter classes can be plotted as a straight line in terms of diameter at breast height X, so that

$$I = c + mX,$$

where c and m are constants. At the close of a growing season, an initial diameter X would therefore increase to $X' = X + I = X + c + mX = c + (m + 1) \cdot X$ so that $X = (X' - c) / (m + 1)$ and $dX = dX' / (m + 1)$. Substituting these values into the original distribution function $YdX = k \cdot e^{-sX} dX$, we obtain the new distribution function $YdX' = k \cdot e^{-s(X'-c)/(m+1)}$

[3] For a fuller discussion of the balanced structures of uneven-aged forests see the author's paper "Management without rotation," Jour. Forestry 41: 126-132. 1943.

$\cdot dX'/(m+1)$. In this expression the new diameter X' may again be designated by the old symbol X. The increase in number of trees in a given diameter interval dX is then found to be equal to the difference

$$k \cdot e^{-s(X-c)/(m+1)} \cdot dX/(m+1) - k \cdot e^{-sX} \cdot dX$$

If we express this difference in percent of the original number of trees in a given diameter interval, we obtain

$$\text{Increase (\%)} = \left(\frac{1}{m+1} \cdot e^{-sI/(m+1)} - 1\right) \cdot 100 \quad (1)$$

Since the change of average diameter growth by diameter classes (characterized by m) is always small, we have with sufficient approximation for all practical purposes

$$\text{Increases (\%)} = (e^{sI} - 1) \cdot 100, \quad (2)$$

where I is the average diameter growth of a particular diameter class. Within a given diameter class the percentage increase in number of trees is, of course, the same as the percentage increase in basal area, cubic foot volume, board foot volume, or value. Formula 2 can be still further simplified if we remember that the number of trees in successive diameter classes which follow the exponential distribution function actually represent a geometric series. The quotient q of this series is equal to e^{2s} if the trees are grouped into 2-inch classes. We therefore find for the percentage volume increase by diameter classes the expression

$$\text{Increase (\%)} = (q^{I/2} - 1) \cdot 100 \quad (3)$$

This simple formula makes it possible to determine the percentage volume increase by diameter classes for any balanced uneven-aged forest. After subtracting from this gross volume increase the estimated mortality, we obtain at once the net volume increase available for cutting, provided the present structure of the forest is to be maintained. Numerical values for the gross volume increase corresponding to different values of q and I are given in Table 2. The use of this table, and the practical significance of the information contained in the underlying formula, are illustrated in the following two problems or cases.[4]

Applications

The desired growing stock of northern beech - birch - maple - hem lock forests.—Large areas of beech-birch - maple - hemlock forests in northern Pennsylvania, including the Allegheny National Forest, have the general appearance of uneven-aged forests. This is true particularly of the virgin forests still found in that region. A study of the structure of virgin forests made in 1943 clearly reveals that the balanced diameter distributions of these forests follow the law of de Liocourt, that is, they plot as a straight line on semi-logarithmic paper. A wide variety of balanced structures is found to exist. In Table 3 are listed the volumes per acre and the percentage distribution of volume by diameter groups of gradually differing structural types. The proportion of heavy timber becomes progressively larger from Type A up to Type H. It was found also that a large proportion of heavy timber occurs together with a high percentage of hemlock. There are two possible ways of interpreting this fact. There may be localities and site conditions on which there is permanently a high proportion of hemlock, while on other sites hemlock is only sparsely represented. The various structural types may also represent various stages in the development of the virgin forests. Field studies have demonstrated that a gradual change in the composition of virgin stands takes place. A heavy stand of hemlock with hardwoods in the understory will ultimately break up and be replaced by a stand with only a small percentage of hemlock. Later, in the shade of the growing hardwoods, hemlock reproduction will gradually establish itself and in decades to come, hemlock will again become the dominant species in the higher diameter classes. As established from the age of mature hemlocks, a period of 200 to 300 years must elapse before a complete cycle in the evolution of a virgin stand is completed. When considering a period of several decades only, however, the structure of a stand as characterized by one of the types A to H remains essentially the same. A given structural type within an area of fifty to several hundred acres is but a stage in a regional climax or "a long pause in a climatic succession"(*1*).

A recent survey of the Allegheny National Forest and of the private forest lands in Elk, Forest, Warren, and McKean counties of Pennsylvania shows that the actual diameter distributions of the forests in this region also yield a straight line when plotted on semi-logarithmic paper. The average volume per acre, however, is considerably smaller than in the virgin forests, varying between 870 and 1540 cubic feet per acre. The corresponding percentage distributions

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[4] Since the net increase in number of trees in any given diameter class is equal to the difference between the number of trees growing in and out of that class, a simple formula must be available for the calculation of ingrowth. For a balanced diameter distribution, it is found that the number of trees growing into a class containing N trees is equal to

$$\text{Ingrowth} = N \cdot q(q^{I/2} - 1)/(q - 1)$$

or

$$\text{Ingrowth (\%)} = q(q^{I/2} - 1) \cdot 100/(q - 1).$$

Starting with the exponential distribution function and its displacement due to growth, the derivation of this formula is not difficult. At this place, it may be more illuminating to give a brief verification as follows: Since the increase of number of trees in a diameter class containing N trees is equal to the difference of the number of trees growing in and out of that class, we find

Increase in number of trees in class containing N trees

$$= N \cdot q(q^{1/2} - 1)/q - 1$$

$$- \frac{N}{q} \cdot q(q^{1/2} - 1)/q - 1$$

(Ingrowth into class containing N trees) — (Ingrowth into next higher class containing $\frac{N}{q}$ trees)

$$= \left[Nq(q^{1/2} - 1)/q - 1\right] \left(1 - \frac{1}{q}\right)$$

$$= N(q^{1/2} - 1)$$

or

$$\text{Increase (\%)} = (q^{I/2} - 1) \cdot 100$$

which is the formula established before.

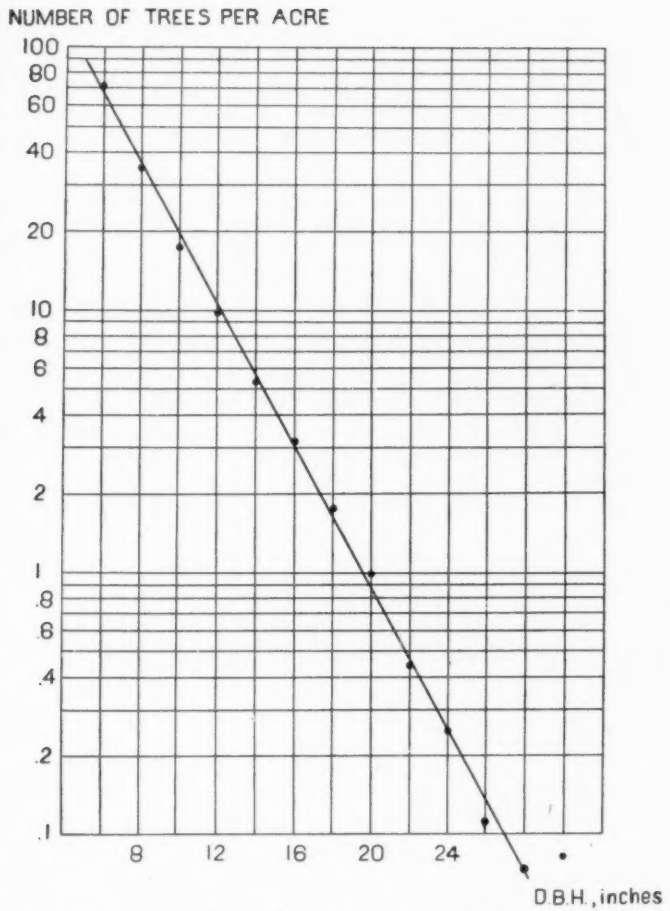

FIG. 2.—Distribution of trees by diameter classes, plotted on semi-logarithmic paper. New Hampshire forest survey.

of the volume by diameter groups are shown in Table 3.

The percentages of volume in small, medium, and large timber, for both the virgin forests and for the total forest area in the four counties, are represented in the triangular graph of Figure 4. The virgin stands with their large diameter trees are, of course, set apart from the areas predominantly in second growth stands. It will be noted, however, that all stands fall into a rather restricted portion of the graph, indicating a definite and limited pattern of volume distribution. None of the second growth areas studied have more than 10 percent of their volume in large timber, whereas all the virgin stands have at least 25 percent of large timber, and some as much as 69 percent.

It is reasonable to suppose that a well managed forest should have a desired normal volume lying somewhere between the volume of the virgin forests and the actual volume of the understocked forests of the region. Second growth stands with volumes over 3,000 or 4,000 cubic feet per acre can be found without difficulty. It would certainly be possible to maintain in the beech-birch-maple-hemlock forests a balanced average volume of between 3,000 and 4,000 cubic feet per acre. This would represent an adequate growing stock for the production of saw timber and other forest products. For the production of pulp wood and minor quantities of saw timber, 2,000 to 2,500 cubic feet per acre may represent a sufficiently large growing stock. From the point of view of practical management, it is not important to narrow this range of possible normal volumes. The actual volume in the national forest, as well as that in the private forests of the region, is well below the minimum goal of 2,000 to 2,500 cubic feet per acre.

From Figure 4 it is seen that with a normal volume between 2,000 and 4,000 cubic feet per acre, the percentage distribution of small, medium, and large timber would be 45:40:15 with a relatively low volume, 35:40:25 with an average volume, and 25:40:35 with a relatively high volume. Depending on site quality, composition of stand, and density, any of the three proposed distributions of volume by diameter groups may be associated with a volume per acre which may vary by an amount of

FIG. 3.—Displacement of diameter distribution due to diameter growth I. The shaded area indicates the number of trees which must be removed in a diameter interval in order to restore the original diameter distribution or forest structure.

about 500 cubic feet above or below the average.

The values of the coefficient q corresponding to the three structural types are 1.6, 1.5, and 1.4 respectively. For a given average diameter growth of, say, 0.20 inch per year, the percentage volume increases for the three types (Table 2) would be 4.8, 4.1, and 3.4 percent. The average diameter growth may, of course, vary from one diameter class to the next and it may be different for different structural types. It is nevertheless certain that the structural type with a rapid diminishing diameter distribution, and hence a relatively low volume per acre, will show a higher percentage volume increase by diameter class than a structural type with a relatively higher volume per acre.

Forest survey, New Hampshire.[5] The forest survey of New Hampshire, covering a commercial forest area of 4.68 million acres, revealed an average growing stock per acre of 811 cubic feet (not including cull trees). It is obvious that the average volume of the state should not be further reduced by overcutting; in fact, it should be substantially increased. We may therefore ask what amount of volume could be removed annually so that the present growing stock would at least be maintained. A certain portion of this gross amount available for cutting would, however, be lost through mortality. Table 4 shows the distribution of trees by diameter classes and the average diameter growth per tree. With these data it is at once possible to determine the percentage gross volume increase by diameter classes. This increase is found to be 4.3 percent for the 6-inch diameter class. It rises regularly up to 6.7 percent for the 30-inch diameter

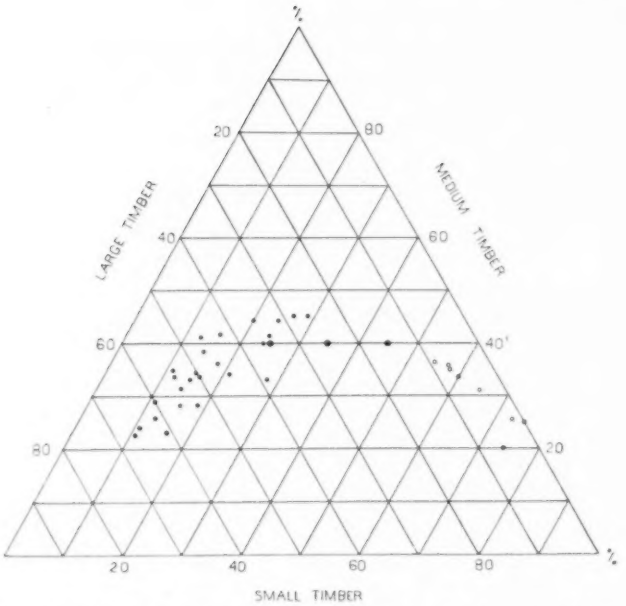

FIG. 4.—Graphical representation of volume distribution in three main diameter groups of beech-birch-maple-hemlock forests in northern Pennsylvania: ● = Virgin forests; o = Actual volume on private and national forest land; ⊙ = Desired volume distribution.

TABLE 3.—STRUCTURE OF BEECH-BIRCH-MAPLE-HEMLOCK FORESTS OF NORTHERN PENNSYLVANIA

Forest or structural type	Volume per acre in trees 7 inches and larger	Distribution of volume by diameter groups: Small 7-13 inches	Medium 13-21 inches	Large 21 inches and larger
	Cubic feet	*Percent*	*Percent*	*Percent*
Virgin forests (gradually differing structural types)				
A	2,810	28	39	33
B	3,290	24	37	39
C	3,780	21	36	43
D	4,330	18	34	48
E	4,780	15	31	54
F	5,300	12	29	59
G	4,740	10	26	64
H	3,300	8	23	69
Forest survey data				
National Forest Land				
Elk County	1,010	75	25	0
Forest County	880	73	25	2
Warren County	1,300	57	36	7
McKean County	1,680	55	36	9
Private forest land				
Elk County	970	74	20	6
Forest County	1,270	60	34	6
Warren County	1,540	58	35	7
McKean County	1,310	65	31	4
Desired growing stock for management[1]				
A	2,000-3,000	45	40	15
B	2,500-3,500	35	40	25
C	3,000-4,000	25	40	35

[1]Tentative values; volume may fluctuate considerably for a given percentage distribution of growing stock by diameter groups.

[5]Grateful acknowledgement is made to V. L. Harper, director, and C. A. Bickford, statistician, Northeastern Forest Experiment Station, for supplying the data of the New Hampshire Forest Survey. Special thanks are due to Mr. Bickford for reviewing the entire manuscript. The forest survey data for Scott County, Mississippi, shown in Fig. 1, have been obtained through the courtesy of W. A. Duerr of the Southern Forest Experiment Station.

class. For the entire stand above the lower diameter limit of measurement (5 inches), the percentage volume increase is equal to 4.9 percent or 39.5 cubic feet per acre. Since gross volume increase is equal to gross growth of the initial volume (including mortality) plus ingrowth, the 39.5 cubic feet can be broken down as follows:

	cu. ft.	*percent*
Gross growth of initial volume	25.4	64
Ingrowth	14.1	36
Gross increase (per year)	39.5	100

By subtracting from the gross increase the estimated mortality losses, we obtain the amount of volume available for cutting, provided the present growing stock is to remain unchanged. In order to obtain a certain desired increase of the present volume, the annual cut will have to be accordingly reduced.

Volume Increase Versus Volume Growth

The formula for the calculation of gross volume increase by diameter classes reveals some important relationships, the significance of which may probably not have been sufficiently recognized in the past. First of all, it is evident that gross volume increase or the possible sustained gross yield in a balanced forest depends not only on average diameter growth, but also on the form of the existing diameter distribution. Table 2 indicates, for example, that with an average annual diameter growth of 0.2 inches, the annual cutting percent would be equal to 3.4 for a distribution coefficient q equal to 1.40, but 4.1 for a q of 1.50. Within such a limited range of different structures, the average total volume per acre of the forest may be the same in both cases. The total yield, as well as the yield in percent of volume, however, will be markedly different.

The gross volume increase in percent of volume given by the formula $(q^{1/2}-1) \cdot 100$ is roughly proportional to the average diameter growth I. For large forest areas, or for uneven-aged forest with a well balanced diameter distribution, average diameter growth generally increases with diameter. This means that the annual cut which can be made in each diameter class while maintaining a given structure, expressed in percent of the volume in that class, increases as diameter increases. The volume maintained in the upper diameter classes yields therefore a higher percentage cut than the volume of the lower diameter classes. This is true despite the fact that the percentage volume growth per tree decreases as diameter increases. The calculation of growth percent as an indicator of "economic increment" for a forest as a whole is therefore of doubtful value. What can actually be harvested under sustained yield management is not the growth of trees in a certain diameter class, but the *volume increase* in a certain diameter class. It is this volume increase expressed in percent of volume which should be determined as a measure of relative productivity. The differences between growth percent and volume increase in percent of volume is well brought out by the New Hampshire data. From the 6-inch to the 30-inch diameter class the average annual volume increase rises from 4.3 to 6.7 percent, while the percentage volume growth decreases from about 5 to 1 percent.

While growth percent varies according to the unit of measure used, the percentage volume increase within a diameter class remains the same regardless of the unit of measure applied. The estimated mortality can directly be subtracted from the gross volume increase in order to obtain net volume increase. This is not possible when dealing with the volume growth produced by the trees of the various diameter classes.

It should once more be empha-

TABLE 4.—CALCULATION OF GROSS VOLUME INCREASE IN NEW HAMPSHIRE FORESTS FOR LIVE AND SOUND TREES

Diameter breast height	Number of trees per acre	Ratio q[1]	Average annual diameter growth I	Percentage volume increase[2]	Volume per tree[3]	Volume per acre	Gross volume increase per acre
Inches			*Inches*	*Percent*	*Cu ft.*	*Cu ft.*	*Cu ft.*
6	70.74		0.134	4.3	2.17	154	6.6
		2.03					
8	34.90		0.140	4.5	4.82	168	7.6
		2.03					
10	17.23		0.146	4.7	7.32	126	5.9
		1.76					
12	9.78		0.152	4.9	9.89	97	4.8
		1.81					
14	5.39		0.158	5.1	15.2	81	4.2
		1.72					
16	3.13		0.164	5.3	20.5	64	3.4
		1.80					
18	1.74		0.170	5.5	26.7	46	2.5
		1.78					
20	0.98		0.176	5.7	32	31	1.8
		2.18					
22	0.45		0.182	5.9	40	18	1.1
		1.80					
24	0.25		0.188	6.1	44	11	0.7
26	0.11		0.194	6.3	48	5	0.3
28	0.07		0.200	6.5	52	4	0.3
30[4]	0.08		0.206	6.7	56	5	0.3
Total				4.9		811	39.5
Average		1.88					

[1]Ratio between numbers of trees in successive 2-inch diameter classes. The average ratio is best determined by plotting trees numbers on semi-logarithmic paper. A straight line fitted to the data will indicate the average value of the ratio q.

[2]Interpolated in Table 2.

[3]This is an average volume per tree for all species combined. It is determined in such a way that the calculated volume per acre is identical with the net cubic foot volume per acre without bark actually found in the forest survey.

sized that the relationships here discussed apply to more or less balanced structures of entire forests, particularly to uneven-aged forests, and not to individual even-aged stands. From the point of view of sustained yield management, it is the yield of the entire forest which must be considered in order to appraise the productive capacity of an area and to make estimates of the possible yield which can be derived from the forest on a sustained yield basis. As additional data on the structure of different types of managed uneven-aged forests become available, the forest structures capable of producing maximum yields and highest financial returns can gradually be determined. Problems such as the influence of forest structure on average annual diameter growth, of which little is known at the present time, can then be solved.

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Plant and Soil Water Relations on the Watershed[1]

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AN IMPORTANT OBJECTIVE of watershed management is to maintain uniform stream flow by keeping runoff as low as possible during periods of excessive rainfall and as high as possible during periods of low rainfall. Vegetation is beneficial on watersheds during periods of high rainfall because it intercepts some water, removes large quantities from the soil by transpiration, maintains conditions in the surface soil favorable to infiltration and storage, and prevents erosion. During periods of low rainfall vegetation is undesirable because it removes water from the soil, thereby increasing the amount of rainfall required to wet the soil back up to the moisture content where it will begin to discharge water into streams.

In regions subject to alternating periods of heavy rain and droughts, the ideal cover would consist of vegetation with a high transpiration rate during the wet season and a low rate during the dry season. Such an ideal cover is probably unattainable; but if we knew enough about the seasonal variations in water use by various plant species, we might be able to manage watershed vegetation in such a way that it would serve its purposes more efficiently.

[1]Paper presented at a meeting of the Division of Watershed Management, Society of American Foresters, Washington, D. C., December 15, 1950.

Soil Water Relations

The soil of a watershed can be regarded as a reservoir in which water is stored and from which it is removed by runoff, evaporation, and vegetation. Before considering the effects of vegetation on soil moisture it seems desirable to consider a few of the principles which govern its storage, its movement, and its availability to plants. These have been discussed in detail elsewhere (*15*); hence only the most important concepts will be mentioned here.

In a saturated soil the entire pore space is occupied by water, but within a few hours to a few days gravitational forces cause the water in the larger pores to drain away. That portion of the soil moisture which drains off under the influence of gravity is called gravitational water, and it does not remain in well drained soils long enough to be used by plants. When drainage becomes so slow that change in moisture content becomes negligible, the soil is said to be at its field capacity. The water present in a soil at field capacity is held in films around the soil particles and in the smaller pores and usually is termed capillary water. It is held so firmly that it moves very slowly and does not contribute to stream flow. It is this fraction of the soil water which is drawn on by plants. If no vegetation is present, the moisture content of a soil at field capacity will undergo little change except in the surface foot or two where loss by evaporation occurs. If the soil is permeated by roots of transpiring plants, water is removed until absorption becomes so slow that permanent wilting occurs. The soil is then said to be at the permanent wilting percentage.

The field capacity and the permanent wilting percentage of a soil are important values to plant scientists because they define the upper and lower limits of that portion of the soil moisture which is readily available to growing plants. Field capacity is an important value to hydrologists because it indicates the soil moisture content at which water movement becomes too slow to contribute to stream flow. Since plants remove only that fraction of water which cannot contribute to stream flow anyway, one might suppose that absorption of water by plants has little effect on the yield of a watershed. This is not true, however, because the soil must be wetted to above field capacity before it will begin to discharge water into streams. If a soil is at field capacity when precipitation occurs, whatever water enters it will release an equivalent quantity into the drainage system; but if the soil is drier than field capacity, enough rain must fall to wet it to field capacity before it

will yield any water. The amount of water required to wet a given volume of soil varies widely, but it is usually relatively low for sandy soils and high for clays. About 1.2 inches of water are required to wet a foot of the sandy loam soil studied by Kramer and Coile (*16*) from the permanent wilting percentage to field capacity. About 2.2 inches would be required to wet their clay soil to field capacity. Since vegetation can remove all the readily available water to the depth of several feet, several inches of precipitation are required to replace it before drainage will occur. In the absence o vegetation, a smaller loss would occur because in most soils the loss by evaporation occurs largely from the surface foot of soil; hence only an inch or two of rainfall would be required to recharge the soil to a moisture content high enough to permit drainage to begin.

Vegetation in Relation to Water Storage

Vegetational cover reduces the amount of water reaching the soil because considerable amounts of precipitation are intercepted by the foliage and evaporated back into the atmosphere. Kittredge (*11*) cites data of Hursh indicating that interception of precipitation by a mature mixed hardwood forest in western North Carolina amounted to 17 percent of rainfall in the summer and 6.6 percent in the winter. A 45-year-old stand of shortleaf pine intercepted about 16 percent of the total rainfall in the summer and about the same amount in the winter. Data of Dunford and Niederhof (*6*) and others indicate that interception by open forest stands and by grass is much less then interception by fully stocked stands. Apparently under some conditions one of the chief causes of the increase in water yield occurring after stands are thinned is the decrease in loss by interception.

One of the important functions of vegetation is its effect on the development of soil conditions favorable to the infiltration and storage of water. Decaying litter provides the organic matter needed to insure development of a large population of soil organisms which aid in maintaining good soil structure; decaying roots provide channels which facilitate infiltration and downward percolation of water.

Some differences seem to exist in the relative effectiveness of litter from different species in developing and maintaining favorable soil conditions. According to Coile (*2*) pure stands of pine or white oak do not produce the most satisfactory type of humus because their litter is too low in calcium. Dogwood and yellow poplar in contrast, produce leaves high in calcium which decompose more rapidly and produce conditions most favorable for development of a large population of soil organisms. Coile suggested that mixed stands, particularly those containing dogwood in the understory, are most likely to maintain satisfactory soil conditions. In a later study Coile (*3*) reported that water infiltration was greater in broomsedge fields and in 70-year-old pine stands than in young pine stands or in mature oak forest.

The most important effect of vegetation on water storage is through the direct removal of large quantities of water by transpiring plants. In the southern Appalachians, Hoover (*9*) found that a hardwood forest removed from 17 to 22 inches of water annually. Kittredge (*10*) estimated the evapotranspiration losses from southeastern pine forests at 30 inches, those from oak-hickory forests and tall grass prairie at 20 to 30 inches. Since evaporation removes water chiefly from the surface foot or two of soil, but transpiration removes it from depths of several feet or as deeply as roots penetrate, losses by transpiration are usually considerably greater than losses by evaporation. This is particularly true on deep soils.

Factors Affecting Transpiration

The magnitude of the water losses resulting from transpiration makes it obvious that the factors affecting the process deserve careful study. Much of the data on water losses by trees are based on the behavior of potted seedlings, or phytometers. It is well known, as Minckler (*17*) has stated, that results obtained with phytometers usually give excessively high results when applied to forest stands. Nevertheless, it seems possible that pot experiments can give useful information concerning differences between species, seasonal trends, and the effects of various environmental factors on transpiration which it would be impractical to obtain from large scale watershed experiments. The results obtained from pot experiments also can serve in some instances as guides in determining what sort of watershed experiments are likely to be most productive.

Since most of the water is lost from the leaves, and since there are large differences among species with respect to leaf anatomy and leaf area, differences in rate of water loss would also be expected. More exact knowledge concerning differences between species might enable foresters to choose those species for watershed cover which would best serve the needs of a particular locality.

It is often supposed that trees bearing thick, heavily cutinized leaves have lower transpiration rates than trees bearing thin leaves, but this is not necessarily true. Trees bearing thick leaves actually often have higher transpiration rates per unit of leaf surface than those bearing thin leaves. According to data of Caughey (*1*), *Ilex glabra* and *Gordonia lasianthus*, which bear thick, leathery leaves transpire more per unit of surface than poplar, which has thin leaves. Holch (*8*) observed that bur oak and hickory transpire more per unit of leaf area than red oak and linden, which have much thinner leaves. Swanson (*20*) found the transpiration rate of *Ilex opaca* to be higher than that of coleus and tobacco. He concluded that leaf structure is not a reliable indicator of differences in transpiration among species.

It is generally assumed that pines lose less water than broadleaved species. This is true in terms of water loss per unit of leaf area,

but is not always true in terms of water loss per tree from trees of equal crown volume. During a careful comparison made in our laboratory, loblolly pine transpired much less rapidly than yellow poplar and northern red oak on a leaf area basis. The total leaf area of the pines was about three times that of the two hardwoods; hence the total loss per tree was higher for the pines. The crown volumes of the various species used in these studies were similar. Groom (*7*) many years ago pointed out that conifers do not always have low transpiration rates and that they sometimes lose as much or more water per tree as hardwoods of similar size. In estimating water use, water loss per tree probably is often more important than water loss per unit of leaf area.

If these data are indicative of conditions in the forest, then conversion of a watershed from hardwoods to pine might increase transpiration losses. Probably interception would also be higher, since it would continue unchanged in a pine forest during the winter, but would decrease in a hardwood forest after leaf fall. The higher winter interception of pine might be an advantage in regions of heavy winter rains, but would be disadvantageous in late autumn and early winter when rainfall and soil moisture are often low.

Large seasonal variations in transpiration occur. Few measurements of transpiration of trees have been made over an entire growing season, but it is obvious that water loss increases rapidly in the spring as new leaves unfold. According to Weaver and Mogensen (*22*) there is a gradual decline in transpiration during the early autumn before the leaves fall. In general, it is probable that transpiration reaches its maximum about the time maximum leaf area is attained, then decreases slowly as an increasing proportion of the leaves become senescent, and decreases very rapidly as leaf fall begins. Further studies of seasonal transpiration might reveal differences between trees which complete most of their growth early in the season and those which continue to produce new leaves until late in the summer.

Studies by Weaver and Mogensen (*22*) and by Kozlowski (*12*) indicate that winter transpiration of conifers is almost as low as transpiration from bare branches of deciduous trees, at least under some climatic conditions. This probably is at least partly because cold soil hinders water absorption by conifers in the winter. It is probable that in the autumn and during periods of mild winter weather, transpiration of conifers may be much higher than transpiration of bare deciduous trees. More information is needed concerning seasonal differences in water loss of conifers and hardwoods. While the most useful information might be obtained from large scale watershed experiments, some useful information can be obtained at much less cost from pot experiments.

Another factor affecting the amount of water removed by vegetation is the depth of root systems. Obviously the greater the volume of soil occupied by roots, the greater the volume of water removed. There are considerable differences among species in respect to depth of root systems, dogwood being a notably shallow-rooted species, while pines often send roots to a depth of many feet. In heavy soils where most of the roots are concentrated near the surface, species differences are probably of less significance than in well aerated soils where deep penetration is possible. In mature Piedmont forests the surface soil is completely occupied by roots regardless of the species, and age of stand is probably more important than species. In well aerated soils deep-rooted species often remove water to depths of many feet. Wiggans (*23*), for example, found apple trees in Nebraska absorbing water from a depth of over 30 feet. Some herbaceous species, such as alfalfa, are also very deep rooted in certain soils and absorb water from considerable depths. Obviously where water conservation is the chief objective, shallow-rooted species with a small transpiring surface would be desirable. This suggests that trees on a watershed where water yield is the primary consideration might be cut before attaining maturity. Young stands of small trees have shallower root systems and smaller crowns than mature stands. Furthermore, the decaying root systems of the cut trees would open up numerous channels in the soil which would tend to increase infiltration and percolation of water.

It seems probable that conversion of forests to relatively shallow-rooted, herbaceous vegetation would sometimes result in considerable increase in water yield. Loss by evaporation might increase somewhat over that from forest soil, but this increase will seldom equal the decrease in loss from transpiration and interception. Croft (*5*) describes an example of such a conversion from forest to herbaceous vegetation. Wilm (*24*) and Munns (*18*) have summarized the varied roles of vegetation on watersheds and discussed some of the possibilities of changing the type of plant cover.

Soil Factors Affecting Water Loss

As the rates of absorption and transpiration are closely related, any soil factors which affect absorption will also affect water loss by transpiration. On a watershed the most important factors are likely to be soil moisture and soil temperature.

An important question is the extent to which rate of transpiration decreases as the soil dries. Veihmeyer and Hendrickson (*21*) claim that water is equally available from field capacity down almost to permanent wilting, but there is some evidence that this is not always true, especially in clay soils. The forces with which water is held increases as soil moisture decreases; hence less absorption would be expected from dry soil than from soil at field capacity. Schopmeyer (*19*) found that transpiration of pine seedlings decreased as soil moisture decreased, long before permanent wilting was reached. Kozlowski (*13*) obtained similar results with oak and pine seedlings.

Transpiration of oak was decreased less than that of pine, probably because the former had more extensive root systems. Coleman (*4*) reported that at San Dimas evapotranspiration rates were higher during the rainy season than at any other time, at least partly because of the higher soil moisture content at that season.

The highest water losses occur from vegetation growing at the margins of streams and bodies of water where the roots are always in contact with soil wetted to field capacity or higher. In general, decreasing soil moisture probably reduces the rate of water loss from a forest stand; and it is quite certain that the total water loss is higher where the soil is kept wetted nearly to field capacity than where it occasionally dries down nearly to permanent wilting.

Soil temperature is a limiting factor on water absorption during the winter. Experiments by Kozlowski (*12*) and by the writer (*14*) show that cooling the soil greatly reduces water absorption by pine seedlings. Furthermore, there are differences between species, absorption by northern species being reduced less than absorption by southern species. It seems possible that in winter, other things being equal, a white pine stand might lose more water than a loblolly pine stand of similar age and density of stocking.

Summary

Trees and other vegetation affect soil moisture indirectly by modifying interception, evaporation, and the soil conditions controlling infiltration; but the most important effect is direct removal of water by transpiring plants. Transpiring vegetation removes water in the range from field capacity to permanent wilting.

Plants of different species have widely different transpiration rates, but leaf structure is not a reliable indicator of transpiration rates because some plants with thin leaves have lower rates than other plants with thick, heavily cutinized leaves. Although loblolly pine has a low rate of transpiration per unit of leaf area, it has a large leaf area and a high rate of water loss per tree.

Large seasonal variations in transpiration occur, maximum water loss probably occurring about the time maximum leaf area is attained. Midwinter transpiration of pine seems to be nearly as low as that of deciduous species.

Shallow-rooted species usually remove less water than deep-rooted species, especially on deep soils. Shallow-rooted species are therefore preferable on watersheds where water yield is a primary consideration.

Rates of water absorption and transpiration decrease as the soil moisture content decreases toward the permanent wilting percentage, and highest water losses occur from vegetation growing in soil with a moisture content near field capacity.

More data are needed concerning the water relations of various tree species. While results obtained with potted seedlings cannot be applied quantitatively to forest stands, they probably give useful indications of differences between species, seasonal trends, and effects of environmental factors. Considerable experience is necessary, however, in interpreting and applying such results.

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Cativo

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DURING THE past three years a tropical American timber that formerly was not used, even in the countries where it grew, has been imported into the United States on an increasing scale.

This timber is cativo, *Prioria copaifera* Gris., of the Caesalpinoidae sub-family of the Leguminosae. The tree has alternate compound leaves with two pairs of leaflets 3 to 5 inches long, elliptic, leathery, glabrous, and dull olive green in color. The flowers are small and without petals, in open branched racemes. They are yellowish tan in color and in blooming time so cover the trees that they may be distinguished from the air at considerable distances. The fruit is a flattened woody ovate pod 2½ to 4 inches long containing one large "bean." The fruits hang in clusters at the tips of the twigs. Cativo seems to bear fruit abundantly every year.

The wood may be distinguished as follows: medium hardness and weight, quite uniform grain; sapwood varying from cream color to tan; heartwood walnut brown, often with an attractive stripe. Abundant scattered gum ducts, larger than the pores, are full of brown gum and show plainly on longitudinal sections, especially in the sapwood. Parenchyma is found in haloes around the pores and sometimes in irregularly spaced concentric lines. The rays are fine but fairly distinct on radial surfaces. There are no ripple marks.

FIG. 1.—A cativo tree 48 inches d.b.h. in Costa Rica. Note dense jungle ground cover and undergrowth.

Quality of the Timber

In the summer of 1946 the writer tested cativo for specific gravity, shrinkage, and hardness. No bending tests were made because the purpose of the tests was to determine the suitability of the wood for veneer for plywood, and in plywood hardness — resistance to abrasion—is the important strength factor. Tests were made by methods similar to those used at the Forest Products Laboratory at Madison, Wis. and described in Technical Bulletin No. 479 of the U. S. Department of Agriculture: *Strength and Related Properties of Woods Grown in the United States.* Thus cativo could be compared directly with native American woods whose physical characteristics are listed in the bulletin.

Table 1 shows the specific gravity, weight, shrinkage factors, and hardness of cativo and of several comparable native woods.

While cativo sapwood is almost as hard as the heartwood, it has a considerably lower specific gravity oven dry. Although the green sapwood of cativo has a lower moisture content than comparable native hardwoods, its heartwood has an extremely high moisture content. This probably accounts for the very high shrinkage factors of the heartwood. The hardness of cativo falls midway between red gum and yellow poplar; cativo sapwood, with approximately the same specific gravity as basswood, is much harder than the latter.

FIG. 2.—A cativo tree 54 inces d.b.h. This tree was 120 feet to the first limb.

Cativo sapwood has very low shrinkage factors, lower than any U. S. hardwood and comparable to North American softwoods. Table 2 compares the shrinkage factors

TABLE 1.—COMPARISON OF CAVITO WITH SOME NORTH AMERICAN WOODS

Species	Specific gravity (oven dry)	Moisture content	Weight		Tangential	Shrinkage		Hardness (tangential surface)
			Green	Oven dry		Radial	Volumetric	
		Percent	*Pounds per cubic ft.*			*Percent from green*		*Pounds*
Red gum[1]	0.53	81	60	33	9.9	5.2	15.0	690
Tupelo gum[1]	0.52	97	65	33	7.6	4.2	12.5	880
Cativo heartwood[2]	0.50	121	69	31	[3]	[3]	22.9	570
Yellow poplar[1]	0.43	64	44	27	7.1	4.0	12.3	450
Cativo sapwood[2]	0.41	56	41	26	6.4	2.6	9.2	545
Basswood[1]	0.40	105	51	25	9.3	6.6	15.8	410

[1]From U. S. Dept. Agric. Tech. Bul. 479.
[2]From tests made by the writer on 15 logs from Costa Rica.
[3]Not determined because of excessive warping of test samples.

of cativo sapwood with certain hardwoods that are generally considered to "hold their place" well, and with four high quality softwoods.

It will be noted from Table 2 that cativo sapwood is very similar in shrinkage to white pine.

Cativo sapwood seasons readily without cupping or distortion, as might be expected from its low shrinkage factors. The heartwood, on the other hand, is difficult to dry kiln, because of its high moisture content and excessive shrinkage, and there is danger of collapse and honey-combing. Much experimental work remains to be done before a satisfactory drying schedule for cativo heartwood can be evolved.

TABLE 2.—COMPARATIVE SHRINKAGE FACTORS OF CATIVO SAPWOOD

Species	Percent of shrinkage Radial	Tangential
Cativo sapwood[1]	6.4	2.6
Black cherry[2]	7.1	3.7
Chestnut[2]	6.7	3.4
Yellow poplar[2]	7.0	4.0
Black walnut[2]	7.1	5.2
Port Orford cedar[2]	6.9	4.6
Red cedar[2]	6.7	3.1
Bald cypress[2]	6.2	3.8
White pine[2]	6.0	2.3

[1]From tests by the writer.
[2]From U. S. Dept. Agric. Tech. Bul. 479.

Range and Growth

The commercial range of cativo includes the Atlantic Coast of Central America from southern Nicaragua well into Panama, portions of the watersheds of the Bayano River and of the rivers that drain into the Gulf of Darién (both on the Pacific side of Panama, east of the Canal), and areas at the mouth of the Atrato River which empties into the Caribbean Sea near the Panama border. Nearly all the exploitation of this timber is now confined to Costa Rica, from near the Nicaraguan border to the Panama line.

Cativo is a tropical rain forest tree and, unlike most other tropical American trees, is characteristically found in pure stands. It grows in two types of sites:

1. In mucky soils in swamps which sometimes are covered with water a portion of the year. Here, cativo nearly always grows by itself, but sometimes has a mingling of cedro macho (*Carapa* spp.).

2. In fairly rich loamy soils on slopes lying inland from the low coastal plains but never more than a few hundred feet above sea level. On such sites there may be pure stands of cativo, or it may be mixed with cedro macho, fruta dorada (*Virola* spp.), jabillo (*Hura crepitans*), pilón (*Hieronymia alchornioides*), laurel (*Cordia* spp.), ceiba (*Ceiba pentandra*), and Spanish cedar (*Cedrela* spp.). Even in these mixed stands cativo usually accounts for three-fourths of the commercial volume.

It is seldom that cativo (when in pure stands) runs less than 10,000 board feet to the acre; over large areas 20,000 feet is a fair average; individual acres are encountered with a stand of 50,000 feet or more. The trees of commercial size range from 24 inches d.b.h. up to 48 inches, with an occasional specimen reaching 5 or 6 feet in diameter. The trees are very straight and symmetrical, resembling virgin red gum or yellow poplar. Cativo does not have buttresses. Clear lengths are seldom less than 40 feet and many trees are from 100 to 125 feet to the first limb (Figs. 1 and 2).

Since tropical trees do not have annual growth rings, it is not possible to determine the age of cativo trees. Because of the year-round growing season and the good soil where cativo is found, it is quite certain that growth is rapid. The relative age of cativo trees may be judged by their bark. If the bark is smooth, thin, and grey, the tree is mostly sapwood and is presumably fairly young (Fig. 3). On the largest and apparently oldest trees, which are nearly all heartwood, the bark becomes thicker and browner and exfoliates in thin plates like certain types of white oak. The sapwood of cativo is at present more highly regarded than the heartwood.

Cativo forests are all-aged. The seeds are not carried far, since they are too heavy to be windborne and are not relished by animals or birds. In a cativo stand there is often an almost complete

FIG. 3.—Native bucking felled cativo tree with axe. Note that this tree is nearly all sapwood.

FIG. 4.—A truckload of cativo logs ready to haul from the swamps to the railroad, for shipment to Limón, Costa Rica. Note relative proportions of heartwood and sapwood.

ground cover of seedlings that have germinated where the seed fell. No studies of relative tolerance have been made in the regions where cativo grows, but it is the writer's opinion that cativo may be classed as quite tolerant.

The growth characteristics of cativo indicate a selective type of felling. This is borne out by the fact that the United Fruit Company cleared many thousands of acres of cativo forest to establish banana plantations. Banana culture was later abandoned and the land has grown back to timber, but cativo is not a factor in this second growth forest, which is entirely made up of species whose seeds are wind-borne, such as balsa (*Ochroma* spp.), laurel, Spanish cedar, and ceiba.

As the present market for cativo is for large logs suited for making rotary veneer, the usual diameter cutting limit is about 24 inches, and this selective type of cutting is quite satisfactory from a silvicultural point of view. It is evident that cativo is a climax type of forest and it is not believed that cuttings of the type mentioned above will have any tendency to convert a stand of cativo to other species.

It is not probable that the present area of cativo forest will change to any great extent, at least in Central America. Hundreds of thousands of acres of cativo forest were clean cut by fruit companies some two generations ago and the trees either burned or allowed to rot where they fell, but this clearing was limited to land suited to agriculture. Cativo stands in swamps and on rough hillsides were left intact and probably will continue to remain in forest. And, as already stated, cativo does not seed in on abandoned land, so the present area of cativo will not increase.

Standing cativo timber has few enemies. Forest fires are nowhere a problem. The range of this species is outside the hurricane belt and winds of sufficient force to overthrow live trees are very infrequent. No diseases or insect pests have been observed that cause any considerable damage to standing cativo timber.

Logging

Heavy equipment is a necessity in logging cativo. Freshly cut cativo logs average about 4 tons to the thousand feet, Doyle rule. Sixteen foot logs usually contain an average of about 500 board feet, or 2 tons per log (Fig. 4).

Nearly all the cativo being cut in Costa Rica, where exploitation centers at the present time, is logged with large crawler-type tractors equipped with yarding winches. Usually the entire bole is dragged out, to be cut into logs beside a railroad or a road that trucks can use. It is not uncommon to drag the tree trunks a mile or more. Ground skidding, using return haul cables, is also practiced. Overhead skidding has not been tried but would seem to be feasible, especially in the deeper swamps and on ravine-cut slopes.

It is the "custom of the country" in Costa Rica to fell cativo with heavy, long handled, single-bit axes, the top cut being made with the same tool. Bucking is also sometimes done with axes. Ordinary cross-cut saws can be used for bucking if kerosene is used copiously to cut the gum. This gum does not bother power-driven chain saws, which are being used to an increasing extent for bucking.

Little cativo is sawed into lumber. The wood is not liked locally for house construction because it is not durable when exposed to the weather and is very subject to attack by termites. Trials of cativo for sawed cross-ties have been made in Costa Rica; the wood takes creosote readily. It is not too soft for ties, even under heavy traffic, if metal tie plates are used.

Two principal problems are encountered in the exploitation of cativo. The most serious is pinworms (Ambrosia beetles) which attack the felled trees very quickly and if not checked will riddle the logs. Two methods are used to combat pinworm attack: storing the logs in water, which seldom is feasible, and spraying with an insecticide. The most satisfactory insecticide seems to be benzene hexachloride dissolved in Diesel fuel, in the proportion of about 5 pounds of BHC containing 36 percent of the gamma isomer to 50 gallons of diluent. The surfaces of the logs must be entirely covered and the spraying done before the insects have bored their way into the wood.

Splitting is the second main problem. Cativo is straight grained and the fibers are not well knitted together. Sometimes a tree gives no indication of splitting when it is felled, but evidently internal stresses are set up, for the individual logs split when being bucked.

Splitting is not caused by drying out, although splits may open wider as the log dries. Native axemen claim that splitting is less serious if trees are cut in the waning moon. The best means to reduce splitting is care in felling: making a deep undercut and controlling so far as possible the direction of fall.

Uses

At present, the main use of cativo is for rotary-cut veneer. This use was pioneered by the Plywoods-Plastics Corporation of Hampton, S. C., on the recommendation of the writer. Cativo can and does replace gum and yellow poplar and is largely being used for the faces and cross-bands of flush doors. For the faces, sapwood veneer is needed and must be free from pinworm damage. To a lesser extent cativo is employed for the faces and cores of plywood panels and for lumber cores for plywood and flush doors.

However, cativo can serve other purposes. It takes paints and stains well and is suited for millwork and general interior trim. The low shrinkage factors of cativo sapwood indicate even more exacting uses, such as pattern making. Cativo heartwood is attractive in color and grain and has proved satisfactory, on an experimental scale, for furniture. If the problems of seasoning can be solved, the heartwood, which now is not highly regarded, may come into demand.

The facts that cativo exists in stands amounting to billions of board feet, that these stands are unusually accessible in comparison with most tropical American timbers, that modern logging equipment can be used advantageously, that the species lends itself well to selective logging, that the wood has qualities that adapt it to many uses, and that the supplies of temperate zone hardwoods with which cativo competes are becoming alarmingly depleted, make it safe to prophesy that cativo will play an increasingly important role in world markets.

Occurrence of Clefts in the Wood of Living White Spruce in Alaska

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DURING THE SUMMER of 1949, while engaged in field work for the Alaska Forest Research Center, U. S. Forest Service, the writer had occasion to cut several white spruce [*Picea glauca* (Moench) Voss] trees in a thrifty young stand located a few miles east of Kasilof, on the west side of the Kenai Peninsula. The spruce was 34 years old, with dominants averaging about 5 inches d.b.h., and 25 feet in height. The stand was essentially pure and was located on upland soil. As the trees were being chopped down to obtain basal sections for dating the stand age, it was noted that the chips contained well-defined diamond-shaped clefts. The clefts were even more striking when seen

FIG. 1.—White spruce section from the Kasilof area, showing abundant clefts. The long crack in the lower right developed after the section was dried, being facilitated by the presence of seven clefts, in radial arrangement, in as many annual rings. The scale is 1 inch.

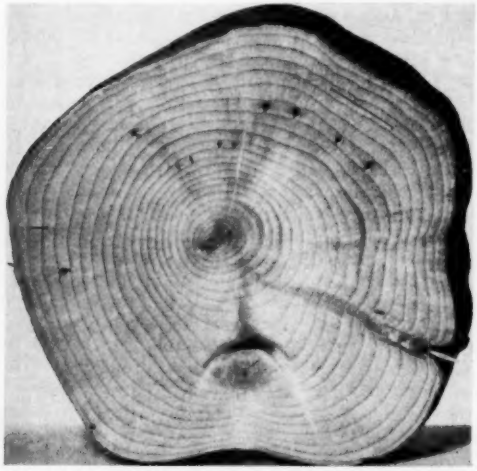

FIG. 2.—White spruce section from the Kasilof area. The five clefts appearing in the ring formed in 1943 developed after growth for the year had ceased and before growth was initiated in 1944. The scale is 1 inch.

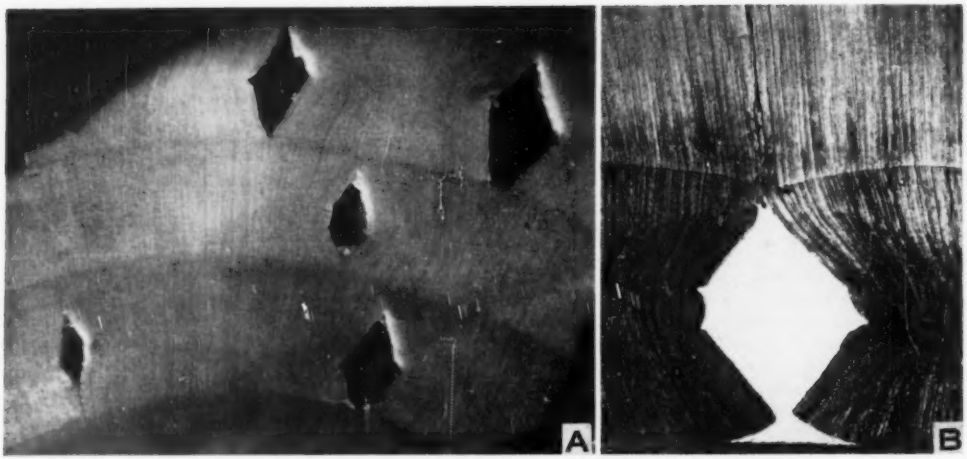

FIG. 3.—White spruce showing collapse. *A*.—From a tree in the Matanuska Valley. Collapse with accompanying distortion of elements may be seen adjacent to the clefts (x 6). *B*.—From a tree in the Kasilof area. The injury occurred in what was then the outermost ring. Traumatic tissue may be seen in the growth layer laid down during the first growing season after the lesion developed (x 10).

on the cut surfaces of the stumps and boles. That they had a considerable longitudinal extension was determined in the field by inserting grass stems 6 to 8 inches into some of the clefts. Three of five trees cut in this stand showed the injury; there were no observed external features which marked the injured trees as different from the uninjured associates. Stem sections were removed and end-coated with a sealing compound to prevent checking. Figures 1 and 2 show the injury in boles from the Kasilof area. During the summer of 1950 similar clefts were encountered in living white spruce in the Matanuska Valley in Alaska.

Examination of the literature and correspondence with experts indicated that this damage to the wood of living trees was of sufficient interest to justify a note on the subject.

In the experience of the writer the injury under consideration has been encountered only in Alaska in white spruce of relatively rapid growth rate. Growth rings in affected trees average about 0.15 inch in thickness. The early wood is thin-walled and the zone of late wood is weakly developed. In cross sections the clefts appear as diamond-shaped openings within the annual rings. The width of the clefts (tangentially) is about 0.10 inch and the length (radially) is about 0.15 to 0.20 inch. In the living tree the lesions do not extend from one ring to another. The long crack in Figure 1 developed *after* the section was dried and was facilitated by the existence, in radial arrangement, of seven clefts in as many annual rings. The clefts are, in some instances, most abundant in certain growth rings (Fig. 2) but in general are distributed in several rings. In the section illustrated in Figure 1 clefts appear in each growth ring from 1941 to 1948, inclusive; as will be noted, it may be significant that no clefts appear in the growth layer laid down in 1949.

Inspection of the figures (particularly Fig. 2 and 3-B) will show that in numerous instances the zone of late wood of the rings containing clefts has been drawn inward at the point of injury. It may also be observed that occasionally there is a slight local increase in the width of the growth ring lying immediately outside the one containing the cleft. In Fig. 3-B a band of traumatic tissue is seen extending outward from the point of injury. These features are interpreted as evidence that the clefts were formed during the dormant season in the outermost annual ring. It appears that when the cleft developed the xylem was slightly depressed under the bark, in some cases sufficiently to produce wound tissue and to afford slight stimulation leading to local increased growth in the succeeding ring.

Figures 3-A and B, 4, and 5 illustrate the injury as seen under low magnification. Features that may be noted are the extensive collapse of tracheids, greatest near the middle of the growth layers, and the tearing away of the large, thin-walled cells in the zone of early wood from their bond with the small, thick-walled cells of the late wood of the previous year. These features appear to be characteristic of the injury.

Evidently the clefts are associated in some way with the removal of water from the wood of the living trees. At the outset it was thought that they might result from removal of water from the cell walls during freezing. In other words, it was thought that the clefts might be analogous to checks arising from normal shrinkage which is caused by the drawing together of the micelles of the cell-walls when the water content is reduced below the fiber saturation point. Bailey (*1*) reported the oc-

currence of small radial cracks or clefts associated with frost rings in *Abies balsamea* (L.) Mill. These resulted from excessive tangential shrinkage. The hypothesis that the clefts in the Alaskan white spruce were caused by normal shrinkage during periods of low temperature was abandoned because the walls of the cells adjacent to the clefts, and for distances of over 0.10 inch tangentially outward, were collapsed; the walls of the cells were drawn together causing them to buckle.

The theory most commonly advanced to explain collapse is essentially as follows (Tiemann, *5*, *6*, *7*). Collapse in wood occurs only under certain conditions. The wood must be wet and initially the cells must be completely filled with water. This water must be free from all gas bubbles. If a bubble of gas occurs within the lumen of a cell, that cell will not collapse when water is withdrawn because the bubble will expand, thus relieving the tension. In living trees these two essential conditions for collapse would be expected to occur most commonly in the outer growth layers where the elements tend to be more completely filled with water than do those in the older wood. The cell walls must be impervious in the sense that they contain no openings large enough to permit air or gas to enter excepting at tensions sufficient to collapse the walls. Under these conditions as water is withdrawn in drying, tremendous tensions are developed—tensions that may amount to hundreds of atmospheres (Tiemann, *7*: 159-160). Hawley (*3*) has indicated that the tension required to pull a meniscus through an orifice of an effective diameter of 70 $m\mu$ into a cell cavity would be about 40 atmospheres. He states, "So great a force may be sufficient in some species of wood to cause collapse in the cell wall; such collapse is frequently observed in dried wood." The elastic limit of the compressive strength perpendicular to the grain in green softwoods is about 34 atmospheres (500 pounds per square inch). According to Stamm (*4*) this corresponds to a relative-vapor-pressure reduction of 0.025 and a capillary radius of 42 $m\mu$. He wrote, "A liquid-tension collapse could thus occur in this wood [western white pine] if it were completely water saturated only in the fibers which had communicating pit membranes with no pore exceeding 42 $m\mu$ in radius." The elastic limit of compressive strength perpendicular to the grain in green white spruce is even lower than the generalized values given above, being about 20 atmospheres (290 pounds per square inch).

Collapse in wood during seasoning and kiln drying is a common phenomenon and is fairly well un-

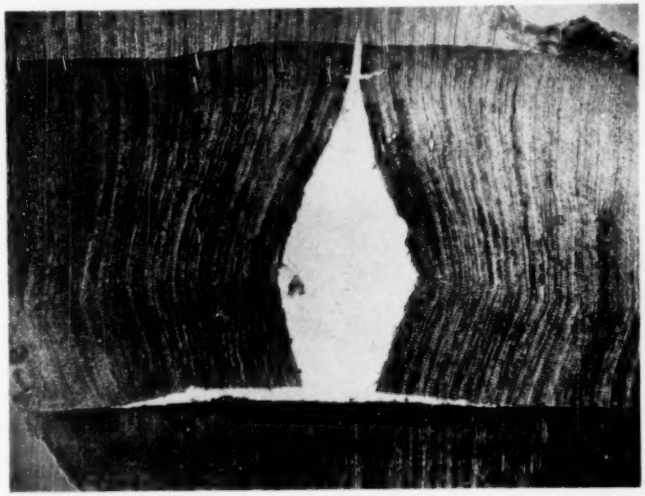

FIG. 4.—White spruce showing collapse, from the Kasilof area. Extension of the upper point of the cleft through the zone of late wood is unusual; presumably this extension, beyond the tangential break, occurred during drying after the stem had been cut (x 20).

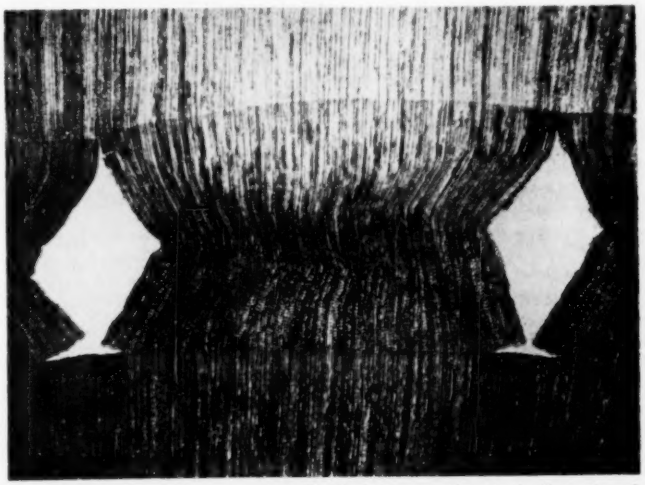

FIG. 5.—Collapse in white spruce from the Kasilof area. The cells in the center of the growth layer have been deformed completely across the distance separating the clefts (x 10).

derstood. Most of the literature on collapse of wood relates to lumber; evidently its occurrence in living trees is less well understood.

Day (2) has described the cracking of certain living conifers in Britain during 1947 and has attributed the injury ("drought crack") to the severe drought of August of that year. The large drought cracks described and illustrated by Day are readily observed since they are external and not purely internal. They are quite different from the lesions encountered by the writer. Dr. Day suggests that the cracks which he observed resulted from collapse of the cells in the outer growth rings (sapwood) because water lost during the drought period could not be replenished. He pointed out an undoubted relation between the occurrence of drought crack and the capacity of the soil to supply water. He wrote, "Sites on which cracking occurred are characterized by a shallow depth of soil which is favorable to root development and by having subsoils which are unfavorable either because of stoniness and lack of water-retentive power, or compaction and impedance in drainage with resulting periodic deficiency in aeration."

Day also observed small wholly internal cracks or clefts in conifers affected by the drought of 1947 in Britain. In personal correspondence he mentions that, in his material, the small internal failures occurred close to the meristem and indicated that they appear to be a type of collapse caused by local withdrawal of water. In his mimeographed report Day states that he had observed internal failures in spruce on two previous occasions. The failures were confined to one annual ring and appeared in cross section as diamond-shaped holes. The clefts observed by the writer in white spruce are similar in many respects to those described by Day.

The environmental conditions responsible for the occurrence of collapse in the wood of living white spruce in Alaska can be postulated but cannot at this time be established with certainty. As previously indicated there is strong evidence that the injury occurs in the outermost growth ring after the late wood has been formed and before the inception of growth the following spring. In other words, the injury occurs during the late fall, winter, or early spring. For collapse to occur in the wood there must exist, in addition to the special internal conditions previously mentioned, an unbalance between water loss and water replenishment. The existence of periods of such unbalance in conifers growing in the Alaskan interior may be postulated on theoretical grounds. They would appear to be most probable during the early spring when transpiration losses may be great owing to relatively high air and foliage temperatures at a time when the soil is still frozen, or at least very cold. The Kenai Peninsula and the Matanuska Valley are slightly south of the limit of permafrost but frozen ground may occasionally be encountered at shallow soil depths in upland forests as late as July. Frozen layers serve to prevent normal drainage; they tend to create a perched water table with accompanying poor aeration. Even in the absence of frozen ground it is certain that the soil under forest stands in these regions is very cold during the dormant period. Low temperatures and deficient soil aeration are both known to inhibit uptake of water by plant roots; these conditions tend to render even wet soils physiologically dry. It may also be pointed out that during certain years soils in the interior of Alaska go into the winter period in a powder-dry condition—so dry that they do not freeze even though the temperature falls to very low levels. This situation is reported to have existed in the Anchorage-Palmer area during the fall, winter, and early-spring period of 1950-1951. Although it seems most probable that collapse in the wood of white spruce trees in Alaska occurs in the late spring it is conceivable that it might occur in the early fall or winter.

Collapse of the type described must be regarded as a serious defect in trees which are to be used for lumber. The collapsed wood does not recover even when subjected to either boiling or steaming. Specimens were boiled for 4 hours and others were steamed for 6 hours but in neither case did the collapsed cells regain their original form. Information as to the occurrence and extent of the defect in different geographic areas in Alaska is almost completely lacking at the present time.

In summary it may be stated that clefts in the wood of living white spruce trees in the interior of Alaska are the result of collapse caused by unbalance between loss and replenishment of water. The injury occurs in the outermost annual ring during the dormant period. Absorption of water from the soil by tree roots during the late fall, winter, and early spring must be completely prevented by frozen ground, or greatly restricted by low soil temperatures and poor soil aeration. Under these conditions water lost by transpiration from the aerial organs cannot be replenished from the soil and unbalance results. Evidently the structure of the wood in the damaged trees is a factor contributing to the injury. Growth is relatively rapid, the early wood is thin-walled, and the late-wood zone is poorly developed.

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A Comparison of Methods for Determining Cubic Foot Volumes of Fence Posts

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THE CUBIC CONTENT of a fence post may be determined by two methods: displacement and calculation. The displacement method requires the use of special equipment. Some formulae require lengthy calculations using several measurements, whereas others are rather simple calculations requiring as few as two measurements. The latter are of particular importance to those who are interested in measuring treating results accurately while conserving field and office time.

The Illinois Agricultural Experiment Station initiated this study in order to decide which method of calculating the volumes of fence posts was best for use in its wood preservation studies. Treating results or standards are usually evaluated by two criteria: the amount of preservative solution absorbed per unit of volume (usually one cubic foot), and the depth to which the solution has penetrated the treated product. The first standard assumes that the volume of the product has been determined accurately, since the measurement of absorption or retention of toxicant can have no greater accuracy than the common denominator on which it is based.

The most accurate method of measuring the volume of a fence post is to measure the volume of liquid it displaces from a xylometer.[2] This method, however, is impractical for general use. Several formulae for calculating post volumes are available. We have not known, however, which formula, if any, would give sufficiently accurate values. Each formula assumes that the form of a post approximates that of the frustum of a simple geometric figure. For instance, the cone frustum formula assumes that the average of the end areas equals the average cross-sectional area of the post; and Huber's formula assumes that the cross-sectional area at the midpoint, on the post represents the average cross-sectional area.

The primary objectives of the study were (1) to determine which, if any, of the commonly used formulae give values within an accuracy of 2.0[3] percent of the volume as measured by the displacement method, and if there is more than one, which one is the most practical to apply; (2) to find a practical means of calculating fence post volumes which are of the same accuracy as other factors used in measuring the absorption of preservative, if none of the formulae give the specified accuracy; and (3) to determine a form factor for loblolly pine fence posts.

Methods and Equipment Used

From approximately 300 peeled and seasoned loblolly pine fence posts, 174 were selected for use in this study. The posts were obtained from a plantation and were typical of those which will result from thinning a 17-year-old plantation that has grown fairly rapidly.[4] Test posts were selected for size, straightness, and freedom from defects which would influence volume determinations (chopped ends, abnormal form, large whirls of knots, rot, or fire scars). Those selected ranged in top diameter from 2.1 to 5.6 inches, and in length from 7.0 to 7.4 feet. The average top diameter was 3.9 inches, and the average length was 7.1 feet.

FIG. 1.—Xylometer made of two 30-gallon range boilers, welded to form a tank 12 inches in diameter and 8 feet long.

Both ends of each post were dipped in melted paraffin to control absorption of water at the ends during displacement tests. Diameter measurements to the nearest 0.1 inch were made with a steel diameter tape at top and butt ends and at the estimated and actual midpoints of each post. Consideration was given to the presence of knots and other irregularities which would affect volume calculations when measuring diameter at the estimated mid-point of the post. The measurement of diameter at exact mid-point, however, was made regardless of irregularity, although the presence of an irregularity was recorded in the field notes. The diameter at actual midpoint was used to calculate post volumes, except for those posts with an irregularity which influenced measurement. For these posts, estimated mid-point diameter was used to calculate volume.

[1]The authors wish to acknowledge the assistance of Professors H. W. Bean and R. W. Touchberry on statistical problems and of Professor W. R. Boggess and his assistants in procuring and preparing posts and making xylometer measurements.

[2]Xylometer: a tank into which wood can be submerged to measure its volume by the amount of displaced water.

[3]Absorption of preservative is generally computed in Illinois Agricultural Experiment Station studies to the nearest 0.1 pound of toxic solution per cubic foot of wood. An average absorption of 6.0 pounds of preservative solution per cubic foot of post is considered to be desirable.

$$\text{A variation of } \frac{0.1}{6.0} \text{ is 1.67 percent.}$$

[4]Boggess, W. R. and R. W. Lorenz. Growth and early thinning of loblolly pine in southern Illinois. Department of Forestry, Illinois Agric. Expt. Sta. Forestry Note No. 7 (mimeo.). July 1, 1949.

TABLE 1.—A COMPARISON OF STANDARD DEVIATIONS FOR POST VOLUMES GROUPED BY LOCATION OF DIAMETER MEASUREMENTS

Diameter group											
	Top				Mid-point				Average-end			
Diameter range	Average	No. of posts	Av. displacement	Standard deviation	Average	No. of posts	Av. displacement	Standard deviation	Average	No. of posts	Av. displacement	Standard deviation
Inches	*Inches*		*Pounds*	*Pounds*	*Inches*		*Pounds*	*Pounds*	*Inches*		*Pounds*	*Pounds*
2.0-2.9	2.6	30	24.48	**4.91**	2.7	5	15.94	**1.43**	2.6	5	15.94	**1.43**
3.0-3.9	3.5	67	35.96	**5.65**	3.5	55	28.99	**4.52**	3.5	58	29.20	**4.46**
4.0-4.9	4.4	50	52.20	**7.35**	4.3	68	44.08	**6.19**	4.4	68	45.14	**6.26**
5.0-5.9	5.2	27	71.63	**6.28**	5.3	43	66.16	**6.55**	5.4	42	67.54	**6.21**
6.0-6.9					6.0	3	82.26	**2.73**	6.0	1	85.81	
Total		174				174				174		

The length of each post was measured to the nearest 0.1 foot.

A xylometer (Fig. 1) was made from two used 30-gallon range boilers cut and welded together to form a tank 12 inches in diameter and 8 feet long. A "V" 6 inches deep and 6 inches wide at the top was cut in the top of the tank. A 7-inch spout was welded into the V-notch to catch the displaced water and to direct it into a container for weighing. The xylometer was placed inside a vertical post treating tank, where it was held in a vertical position by a clip which fitted over the rim of the larger tank.

The xylometer was filled with water to the bottom of the V-notch before each post was submerged into it. The water displaced by each post was caught in a container and weighed to the nearest 0.01 pound. The water was then returned to the xylometer, the water level adjusted, and the scales balanced for the next measurement.

The average volume of the post in each 0.1-inch average-end diameter[5] class was calculated by each of the following formulae:

1. Displacement formula:
$$V = \frac{\text{weight of displaced water (lbs.)}}{62.4}$$
where V is the volume in cubic feet and 62.4 is the weight in pounds of a cubic foot of water.
2. Cone-Frustum formula:
$$V = \frac{0.2618\ L\ (D^2+d^2+Dd)}{144}$$
where V is the volume in cubic feet, L the length in feet, d the top diameter in inches, and D the butt diameter in inches. This formula was simplified to $V = (D^2+d^2+Dd)\ 0.001818L$ for calculations.
3. Newton's (prismoidal) formula:
$$V = L\frac{(A_1+4A_2+A_3)}{6}$$
in which V is the volume in cubic feet, L the length in feet, and A_1 A_2, and A_3 the two end areas and the mid-area, respectively, in square feet.
4. Smalian's formula:
$$V = \frac{(A_1+A_2)}{2}L$$
in which V is the volume in cubic feet, A_1 and A_2 the end areas in square feet, and L the length in feet.
5. Huber's formula:
$V = AL$
in which V is the volume, in cubic feet, A the area at mid-point, in square feet, and L the length in feet.
6. American Wood Preservers' Association (A.W.P.A. alternate method M6-48[6] formula (modified):
$$V = 0.2182\frac{Dm^2}{4}L$$
in which V is the volume in cubic feet, Dm is the mid-point diameter in inches, and L the length in feet. The formula was modified to include L as total length of post, whereas the original formula gives average volume per foot of length.

The authors recognize the fact that the A.W.P.A. formula is basically the same as Huber's, and the volumes obtained by it would be the same; however, a method of calculation was being sought which was simple to use, involved a minimum number of mathematical processes, and was accurate. Therefore, both formulae were included in the volume calculations, althought the results are combined in Table 2.

In calculating post volumes by Newton's, Smalian's, and Huber's formulae, cross-sectional area to the nearest 0.0001 square foot were determined by use of a forester's "basal area" table which gives areas in square feet for circles of various diameters in inches.[7]

Organization and Computation of Data

Post length was assumed to be constant, and the small variations which existed were believed to have an insignificant effect on volume; diameter, therefore, was chosen as the basis for grouping displacement data. Three types of diameter measurements were considered; namely, top, actual mid-point, and average-end. Standard deviations[8] of the displacement figures were used as the basis for selecting the method of diameter grouping. Standard deviations for the average-end diameter group were generally less than those for the other two groups (Table 1) so it was deemed to be the best basis for grouping the data.

[5]Computed by the formula $\frac{D+d}{2}$, in which D and d are the diameters of the butt and top, respectively.

[6]Methods of analysis and sampling and conversion and correction tables. Table 2, Section 4. American Wood Preservers' Association Manual of Recommended Practice. A.W.P.A., Washington, D. C., 1949.

[7]Munns, E. N. Theresa G. Hoerner, and V. A. Clements. Table 18: Converting factors and tables of equivalents used in forestry. U.S.D.A. Misc. Pub. No. 225 (revised June 1949). Forest Service, Washington, D. C.

[8]Standard deviation is a measure of dispersion or variability.

TABLE 2.—PERCENTAGE DIFFERENCES BETWEEN DISPLACED AND CALCULATED VOLUMES FOR LOBLOLLY PINE FENCE POSTS

Post diameter class	No. of posts	Average displaced volume	Formula for calculating post volume							
			Cone-Frustum		Newton's		Smalian's		Huber's and A.W.P.A.	
			Average volume	Percent of displaced volume	Average volume	Percent of displaced volume	Average volume	Percent of displaced volume	Average volume	Percent of displaced volume
Inches		*Cu. ft.*	*Cu. ft.*		*Cu. ft.*		*Cu. ft.*		*Cu. ft.*	
2.0-2.9	5	0.255	0.267	105	0.283	111	0.276	108	0.286	112
3.0-3.9	58	0.465	0.480	103	0.494	106	0.488	105	0.497	107
4.0-4.9	68	0.723	0.751	104	0.757	105	0.762	105	0.755	104
5.0-5.9	42	1.082	1.147	106	1.135	105	1.152	106	1.127	104
6.0-6.9	1	1.375	1.397	102	1.397	102	1.404	102	1.394	101
All posts	174	0.714	0.746	104	0.751	105	0.755	106	0.749	105

Displacement figures for all posts were assembled into one-inch classes having ranges of 2.0 to 2.9, 3.0 to 3.9, 4.0 to 4.9, 5.0 to 5.9, and 6.0 to 6.9 for each of the diameter groups (top, mid-point, and average-end). The number of posts and average diameter, displacement, and standard deviation were determined for each of the 1-inch diameter classes within a diameter group. For example, 30 of the 174 posts had top diameters ranging from 2.0 to 2.9 inches. The average displacement for these posts was 24.48 pounds of water with a standard deviation of 4.91 pounds (Table 1). When the posts were grouped according to their mid-point diameters, 5 of the 174 were classified in the 2.0 to 2.9-inch diameter class, 55 in the 3.0 to 3.9-inch class, 68 in the next larger inch class, et cetera.

Correlation coefficients[9] were calculated for each of the formulae.

Results and Discussion

Table 1 shows a comparison of the standard deviations for post volumes grouped by top, mid-point, and average-end diameter measurements. There is apparently less dispersion or variability when volume data are grouped according to the average of the two end diameters and greatest when grouped by top diameters. It was for this reason that the average-end diameter was selected as a basis for grouping volume data. It was considered better statistical practice to analyze dispersion by computing standard deviations for four individual size classes having rather narrow ranges rather than for one larger group having a wide range.

Correlation coefficients for the formulae were found to be as follows: Cone-Frustum, + .999; Huber's and A.W.P.A., + .998; Smalian's, + .997; and Newton's, + .996. Although the higher correlation coefficient for the Cone-Frustum formula indicates that volumes calculated by it are likely to have a closer goodness of fit or relationship to the true volumes, there is no important difference in the relationship between the volumes calculated by any of the formulae and the true volume.

Table 2 shows the percentage difference between displaced and calculated volumes for all the posts. In the various inch-class diameter groups, volumes calculated by each of the formulae exceeded displaced volume by 1 to 13 percent, and for all diameters by 4 to 6 percent. The three largest percentage differences occurred in the smaller diameter class (2 inches). Generally an increase in post diameter was accompanied by a corresponding decrease in the difference between calculated and actual volume. The least difference between calculated volumes and displaced volumes was obtained by use of the Cone-Frustum formula (only +4 percent), and the greatest difference resulted from the use of Smalian's formula (+6 percent). None of the formulae gave fence post volumes within the accuracy (2.0 percent) set as a goal.

There is a consistent difference between calculated volumes and displaced volumes. In each case, the calculated volume exceeds displaced volume. All volumes were calculated on the same measurements, so that the measurement technique was eliminated as a variable and any difference could be attributed to differences in the formulae. The differences between displaced and calculated volumes may result from the fact that a diameter tape exaggerates cross-sectional areas of posts that are not true circles. The presence of season checks and splits which fill with water from the xylometer (judged to be insignificant for the posts used in these tests) and the absorption of water by well-seasoned posts would also tend to bring xylometer values below calculated volumes.

The figures shown in Table 2 may be used as correction factors for calculated volumes of posts (of a form similar to the test posts) and a length of approximately 7 feet (perhaps 6.9 to 7.1). For example, if the average volume of a group of posts is calculated by the A.W.P.A. formula to be 0.75 cubic feet, the actual volume (determined by correcting for the 5 percent over-run shown for this formula in Table 2) is probably 0.71.

The determination of absorption of preservative solution in terms of pounds per cubic foot of post would be affected by the volume correction. Since there is actually a smaller volume of wood than is shown by the formula, the rate of absorption would be increased by the correction. For example, if the average absorption for a group of posts is found to be 4 pounds of

[9]Correlation coefficient is a measure of the degree of relationship or association between two or more variables. When complete association is present, the correlation is indicated by 1; no association is indicated by 0. The relationship concerned is linear as far as is known. A "plus" sign is used for lines that rise from left to right and a "minus" for the opposite trend.

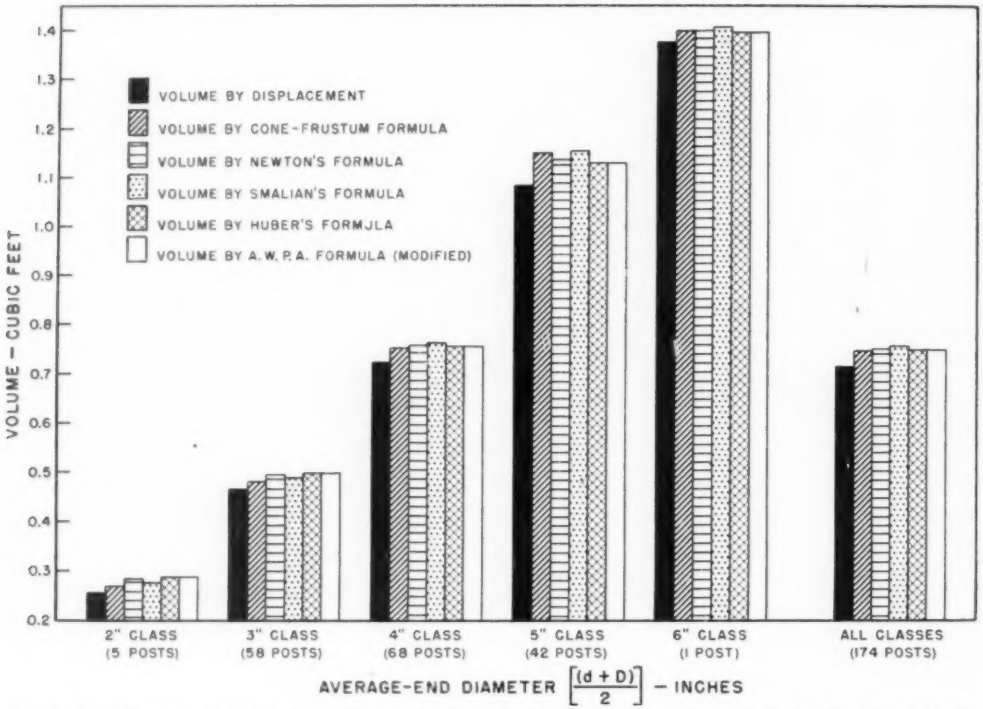

FIG. 2.—Comparison of calculated volumes with actual volumes for loblolly pine fence posts. Form factor, .89. Average length, 7.1 feet.

preservative solution and the average calculated volume is 0.75 cubic foot, the apparent absorption rate would be 5.3 pounds per cubic foot. A volume correction of five percent, however, would increase the rate to 5.6 pounds per cubic foot, or about 6.0 percent.

The same number and type of measurements are required to compute volumes with Huber's and the modified A.W.P.A. formulae. Huber's formula, however, requires considerably less computing time because a table of basal areas may be used.

Figure 2 shows the relative accuracy of the various formulae. The solid black bar represents displaced volume, the basis for the comparisons.

Table 3 shows the displaced volumes of the posts.

It was found that with reasonable care, one could measure mid-point diameter to the nearest 0.1 inch as accurately by estimating the mid-point location as by determining it exactly. In fact, 99.2 percent of the measurements taken at estimated mid-point were within 0.1 inch of those taken at actual mid-point. Measurements made at estimated mid-point were within 0.05 inch (in same 0.1-inch class) of those taken at actual mid-point for 86.6 percent of the posts which were free from any abnormalities at mid-point which would affect diameter measurements.

TABLE 3.—LOBLOLLY PINE FENCE POST VOLUMES DETERMINED BY DISPLACEMENT METHOD FOR POSTS WITH AVERAGE FORM FACTOR OF .89 AND AVERAGE LENGTH OF 7.1 FEET. BASED ON 174 POSTS

Mid-point diameter[1]	Volume	Mid-point diameter	Volume
Inches	*Cu. ft.*	*Inches*	*Cu. ft.*
2.4	.206	4.3	.694
2.5	.222	4.4	.728
2.6	.240	4.5	.762
2.7	.260	4.6	.799
2.8	.280	4.7	.834
2.9	.300	4.8	.870
3.0	.323	4.9	.907
3.1	.349	5.0	.945
3.2	.374	5.1	.980
3.3	.399	5.2	1.017
3.4	.423	5.3	1.053
3.5	.450	5.4	1.091
3.6	.479	5.5	1.129
3.7	.505	5.6	1.165
3.8	.534	5.7	1.201
3.9	.564	5.8	1.240
4.0	.596	5.9	1.277
4.1	.628	6.0	1.314
4.2	.660		

[1]Measured with steel tape.

Since fence posts of different species, and even posts of the same species taken from trees which have grown at different rates, probably have different forms (which would affect their volumes), a "post form factor" was developed. It may be expressed by the following formula:

$$PFF = \frac{D_t}{D_m}$$

where PFF is the post form factor, D_t is the top diameter in inches and D_m is the actual mid-point diameter in inches.

The average PFF calculated for the loblolly pine posts used in this study was .89, with a standard deviation of .05.

The authors conclude that (1) since the volumes calculated by the four different formulae were of approximately the same degree of accuracy when compared to the displaced volumes of loblolly pine fence posts, Huber's formula is the most practical to use, since it required only one diameter and a length measurement and is adapted to the use of a forester's table of basal area; (2) any of the four formulae may be used on a large number (perhaps 50 or more) of posts having a form factor of .89 with the expectation of securing average volumes within approximately 5 percent of the actual volumes.

Growth of Hybrid Aspen in Pot Cultures of the Litter of Forest Plants[1]

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THIS RESEARCH was done during the course of an investigation of the comparable total amounts and chemical composition of the annual litter of tree species and subordinate vegetation in the forests of northwestern Connecticut. The study was designed to test the assumption that chemical analysis might be supplemented by some more direct approach to the value of the litter of various forest plants as suppliers of plant nutrients. One possible method of making such an evaluation is to compare the development of similar plants grown in cultures employing the various types of litter.

Method

The litter of nine species or groups of species representative of the overstory and understory forest vegetation of the region was selected for the experiment. This plant material had been collected in the course of the primary investigation and had been air dried and ground in a hammer-type mill to the point where it would pass through a mesh with round perforations .039 inch in diameter. Analysis for elements of known nutritional value to plants was made by spectroscopic methods using Standard Applied Research Laboratories equipment with spark excitation. The nine types of forest litter and the accompanying chemical analysis for each are given in Table 1.

Each of the nine types of litter was applied at two levels: (1) 1,000 pounds per acre of surface; and (2) 3,000 pounds per acre.

Heavy porcelain pots 14 inches tall and 9 inches inside diameter were filled with washed and graded silica sand. Treatments for individual pots were selected randomly and the appropriate amount and type of plant material mixed into the surface layers of sand. Controls of pure sand were included, two being added to each group of 18 treatments to balance the statistical design. Thus a group of 20 pots covered all treatments and controls and was considered to be a block. There were four replications of this block in various locations in the greenhouse.

The treated pots were set out on April 4, 1949 and were watered periodically until April 29. This was done to allow decomposition of the plant materials to start. On April 29 cuttings of the hybrid aspen clone OP-20[2] were planted in each pot. These cuttings were 6 inches long and were graded to approximately equal diameters. Cuttings were selected in order to eliminate genetic variation from the experiment and hybrid aspen was used because of its reputed sensitivity to varying levels of available nutrients.

On June 24, any cuttings which had developed more than one new shoot were pruned, leaving only the shoot which developed most satisfactorily. This was done to channel new growth into an easily comparable form.

The leaves of the aspen started to yellow about October 15 and all had fallen on November 4, at which time the plants were removed from the pots.

[1]Part of a dissertation presented to the faculty of the Graduate School, Yale University, for the degree of Doctor of Philosophy.

[2]Obtained through the courtesy of Dr. E. J. Schreiner, Northeastern Forest Experiment Station.

TABLE 1.—SPECIES AND CHEMICAL COMPOSITION OF LITTER USED IN POT CULTURE TREATMENTS[1]

Treatment and species	Percent over dry weight									P.p.m. oven dry weight	
	K	Ca	Mg	P	Mn	Fe	Al	Zn	Na	Cu	B
1 *Pinus strobus* L.	.79	1.18	.62	.15	.06	.03	.04	.024	.05	49	25
2 Mixed hardwoods (*Acer* spp. and *Quercus* spp.)	.74	1.88	.85	.21	.19	.04	.03	.024	.07	41	38
3 *Quercus alba* L.	1.07	1.75	.54	.31	.36	.03	.03	.017	.05	37	51
4 *Mitchella repens* L.	2.01	1.91	1.41	.14	.04	.14	.16	.035	.07	66	57
5 *Dryopteris noveboracensis* (L.) Gray	2.14	.75	.41	.13	.08	.02	.08	.012	.02	51	15
6 *Carex pennsylvanica*	1.60	.91	.51	.22	.14	.04	.03	.026	.07	81	27
7 *Rubus hispidus* L.	.72	1.13	.54	.18	.14	.03	.02	.014	.04	42	32
8 *Hamamelis virginiana* L.	1.16	.89	.25	.27	.24	.03	.02	.001	.02	41	47
9 Complete overstory and understory	1.02	.56	.44	.20	.07	.03	.04	.012	.05	45	27

[1]Chemical analysis carried out by the Connecticut Agricultural Experiment Station.

TABLE 2.—GROWTH OF NEW SHOOTS OF HYBRID ASPEN IN POT CULTURES OF THE LITTER OF SEVERAL FOREST PLANTS

Treatment	Length new growth in inches[1]		
	Average	1,000 pounds per acre	3,000 pounds per acre
Pinus strobus L.	13.95	13.51	14.39
Mixed hardwoods	15.08	15.62	14.54
Quercus alba L.	13.54	14.49	12.59
Mitchella repens L.	21.48	19.12	23.84
Dryopteris noveboracensis (L.) Gray	23.44	21.16	25.75
Carex pennsylvanica Lam.	17.58	16.38	18.78
Rubus hispidus L.	16.70	15.95	17.45
Hamamelis virginiana L.	20.93	20.39	21.48
Complete overstory and understory	17.33	14.59	20.06
Control	15.53	15.85	15.20

[1]The least significant difference at the 5-percent level for the average values is 1.85. The least significant difference at the 5-percent level for the 1,000- and 3,000-pound rates is 2.67.

Total length of new growth was considered to be one of the best criteria of development. The new shoots were carefully cut from the old stems and lengths were measured to the nearest 0.05-inch. The data were examined by means of analysis of variance.

Results and Discussion

The statistical analysis showed no significant difference between the four replications or blocks. This could be interpreted as proving that there was little difference in environment throughout the experimental area of the greenhouse.

There was a highly significant difference (1-percent level) between the two rates of application of plant material. The 3,000-pound-per-acre level resulted in an average growth of 18.40 inches. This value was significantly higher than the 16.71-inch average growth produced by the 1,000 pound per acre application. The difference could be interpreted as proving the ability of the hybrid aspen to make a growth response commensurate with the level of available plant nutrients.

The difference between treatments was also highly significant. Table 2 gives the growth response of individual treatments at both levels of litter application and average values.

At the 1,000-pound-per-acre level the *Mitchella repens*, *Dryopteris noveboracensis*, and *Hamamelis virginiana* treatments resulted in significantly better growth than did the control. None of the other treatments showed any significant difference from the control.

At the 3,000-pound level the same three treatments, and in addition the *Carex pennsylvanica* and complete overstory and understory treatments, resulted in significantly greater growth than the control. The other treatments showed no difference from the control. However, only the *Mitchella repens*, *Dryopteris noveboracensis*, and complete treatments were significantly better at the 3,000-pound level than at the 1,000-pound level.

The treatment averages showed that the *Mitchella repens*, *Dryopteris noveboracensis*, *Carex pennsylvanica* and *Hamamelis virginiana* treatments were significantly better than the control, and the complete treatment almost higher. The *Quercus alba* litter produced growth that was significantly lower on the average than the control, although this was not true on the individual levels.

So far as the species used in this experiment are concerned, the litter of subordinate vegetation appeared superior to tree litter in supplying nutrients — at least in so far as hybrid aspen is concerned and over a relatively short period of time.

An examination of the nutrient content of the various types of litter did not reveal any strong correlation with growth, either with individual elements or with total amount of the nutrients studied. The potassium percentages probably were most closely correlated with growth. Even here the correlation coefficient was only +0.60 and was not significant. The final answer might be related to factors such as differential rates of decomposition or the balance or proportion of the various nutrient elements in the several types of litter.

Summary

An experiment was set up to determine the relative ability of the litter of several tree and subordinate vegetation species typical of the forests of northwestern Connecticut in supplying plant nutrients. The various types of litter were finely ground and mixed into cultures with silica sand. Hybrid aspen cuttings of a single clone were planted in these cultures and allowed to grow for 6 months. The criterion of growth was total length of new shoots.

The higher rate of application of plant material (3,000 pounds per acre) produced significantly greater new shoot length than did the lower rate of application (1,000 pounds per acre).

The litter of subordinate forest vegetation generally proved superior to the litter of tree species in producing growth in hybrid aspen, at least in so far as the species used in this experiment are concerned.

There appeared to be little correlation between the content of nutrient elements (nitrogen not measured) in the litter from various species, and the effects of the litter on the growth of hybrid aspen.

Effect of Farm Woodland Grazing on Watershed Values in the Southern Appalachian Mountains

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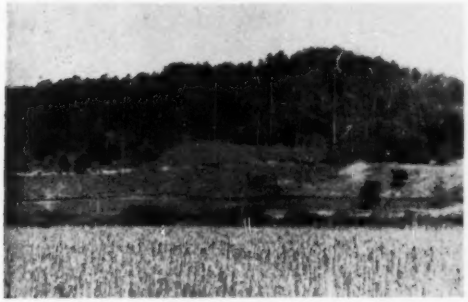

FIG. 1.—Grazed woodland watersheds, often considered flood source and problem areas in the southern Appalachian Mountains.

FIG. 2.—After 65 years of woodland grazing, this area shows exposed mineral soil and lack of vegetative ground cover.

CURRENT PRACTICE on the average mountain farm in the southern Appalachians is to fence the farm woodland in with the pasture. The aggregate area of grazed woodland, though not as great as in the days of open range, is still large—representing 20 to 25 percent of the land area for many mountain counties. What are the effects of this woodland grazing on timber, vegetation, soil, and water in the region? Obviously, woodland grazing does affect these forest resources as shown by the bare soil and the absence of ground vegetation and litter under hardwood stands where cattle have congregated. Grazed woodlots showing bare soil can commonly be seen adjacent to the highways of the southern mountain region. However, very little accurate data and no results of long term watershed studies have been available to give a more precise estimate of the effect of woodland grazing on soil porosity, permeability, and indirectly upon stream flow. Actually, there has been considerable difference of opinion as to the magnitude of increased storm runoff caused by woodland grazing, and as to what extent it causes turbidity in formerly clear streams. The purpose of the present report is to describe changes that have taken place on an experimental watershed under controlled conditions of seasonal grazing by cattle within a hardwood forest typical of the southern Appalachian Mountains.

The experimental watershed study was set up in 1940 at the Coweeta Hydrologic Laboratory in the mountains of western North Carolina. This 5,700-acre laboratory is located in the highest rainfall area in the eastern United States.[1] It contains 36 small drainages with continuous stream flow, each available as an experimental unit and operated to measure the effects of land use on stream flow.

A 145-acre unit watershed was set aside for the grazing study. About fifty storms of ½-inch or more take place each year and these are well distributed throughout all seasons. The soils on the grazing area are relatively deep and permeable, but water tables are sufficiently close to the surface to be observed in shallow wells.

The growing season extends from April 15 to October 15, with a mean temperature of 65 degrees F. Hardwood trees are the dominant vegetation, with pine present on ridges that were repeatedly burned 40 to 75 years ago. No fires have occurred in over 40 years, and cattle had not grazed on this watershed for many years. The area was logged in 1914 and the hardwood forest has grown back without further disturbance. Before the grazing study was started, the forest was typically three-storied, with large trees forming the upper layer, small trees the second layer, and a ground cover of broad-leaved herbs forming the third. Some grasses and legumes were present, particularly along old skid trails and in openings left by fallen trees. It was mainly because of these scattered grasses and legumes that livestock specialists visiting the area before the experiment began considered this particular watershed a potentially valuable source of forage. They also considered it typical of woodlands now being grazed in the region.

The watershed has three forest types which correspond closely to the areas of grazing use, as shown in Figure 3. Previous to grazing, the cove-hardwood sites had a dense ground cover which included native legumes. The oak-hickory type along the slopes had a ground cover of the same palatable species, but the pitch pine type on the ridges had an understory essentially of laurel, azalea, and huckleberry, which cattle do not relish.

Before cattle were put on the area, a 7-year period of standardization was observed. It included first, installing a gauging station at

[1]The recorded annual rainfall for the past 16 years has ranged from 43 to 145 inches. The average has been about 72 inches. Only about 2 percent occurs as snow.

the watershed outlet for measuring stream flow under natural conditions. Measurements were also made of stream temperature and sediment load. Records of precipitation, climate, and water table fluctuations were also kept. The 7-year standardization period before treatment made it possible to evaluate the effects of the treatments measured in the following period.

Starting in May 1941, cattle were put on the area. Since then an average of six "past yearling" cattle have browsed the vegetation and trampled the watershed each year from May to September. This is in keeping with the period that cattle are normally kept on the woodlands in this section. Although the design of the experiment led to overtrampling of the watershed, the end result obtained was entirely comparable to conditions commonly found on typical farm woodlots. By the end of the first grazing season practically all the herbaceous forage and much of the hardwood understory had been used. In subsequent years forage was so scarce that the cattle required supplemental feeding in order to have strength enough to range the area. They have been given a total of approximately 60 bushels of corn and 1,500 pounds of cotton seed meal each season.

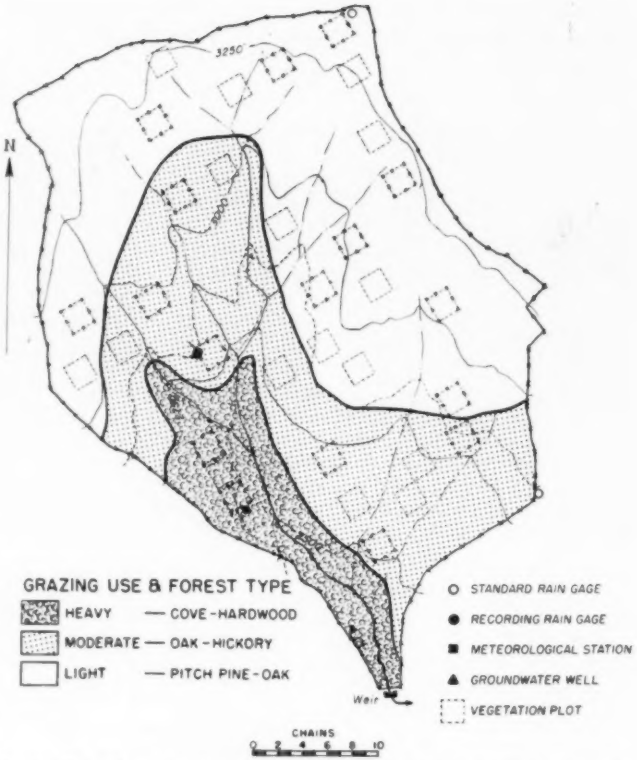

FIG. 3.—The 145-acre experimental watershed comprises cove, slope, and ridgetop.

Grazing Effect on Vegetation

As a basis for the measurement of changes in soil and vegetation, 34 control plots, each 2 chains square, were placed at random over the area. Seventeen of these were fenced and maintained as controls. The other 17 were not fenced. Observations of herbaceous and woody vegetation were made within each of the 34 sample plots in 1940, one year before grazing and then again in 1948 after 8 seasons of use.[2] So far the most pronounced changes have taken place in the cove hardwood type, where the cattle spent most of their time. Being the most fertile area, the cove hardwood type contained the preferred herbs, grasses, and legumes, and these plants have already been reduced to a point where they are no longer conspicuous.

Utilization of understory trees 15 feet in height or less was so complete that in this size class practically all yellow-poplar, ash, black locust, oak, dogwood, sweet birch, and sassafras have disappeared. Trees up to 2.5 inches in diameter were ridden down and tops eaten as shown in Figure 4. Cattle showed a distinct preference for the yellow poplar and black locust, both valuable species.[3] By contrast, within the fenced plots these species of the same size class have made vigorous growth.

Second choice in the search for food was the oak-hickory slopes. These were used very little the first year but more heavily in subsequent years as browse in the coves diminished. On the slopes there were a few places so steep that they were inaccessible to cattle, and consequently these places received little or no use.

Utilization of browsable trees and shrubs have produced noticeable but less pronounced changes in the oak-hickory type. Although the amount of browse has apparently been decreased, the accumulated total effects of 8 years' use in this type has been much less conspicuous than in the cove-hardwood type. General observations, however, indicate that after several decades the oak-hickory type in the experimental watershed will show a trampling effect similar to that on typical trampled woodlots in the locality.

[2]Changes in the minor vegetation and tree growth are still being studied and the results will be presented as a separate report after further field observations have been completed and analyzed.

[3]Biswell, H. H. and M. D. Hoover. Appalachian hardwood trees browsed by cattle. Jour. Forestry 43(9):675-676. 1945.

FIG. 4.—Cove-hardwood forest trees bent over and killed by browsing cattle.

Woody shrubs—largely laurel, buckberry, and azalea — have increased in conspicuousness because these species are not liked by cattle. It is possible that the apparent increase in shrubs is caused by the removal of more palatable competing vegetation, thus favoring current growth as well as the further establishment and survival of these shrub species.

Because the ridges had almost no palatable forage, they received little use. Cattle would usually make one or two tours over the ridges in May and June and not return to this portion of the watershed again.

Trampling action on the soil by cattle in search of feed apparently affected the diameter growth of dominant forest trees. At the end of the ninth growing season, growth measurements were taken on both the fenced and unfenced areas. Yellow-poplar of the 3- to 9-inch diameter class showed 50 percent less diameter growth for the outside five rings, while hickory showed 30 percent and red maple 27 percent less. Further studies of tree growth will be reported at a later date, together with the statistical analysis of the minor vegetation on fenced and unfenced plots.

The reduction in growth rates is attributed to the cumulative effects of compacting the upper 6 inches of soil, where most of the feeding roots are located. In addition, many of the surface roots are killed by exposure through soil erosion. These exposed yellowish roots are plainly visible against the dark-colored soil.

TABLE 1.—CHANGES IN PHYSICAL PROPERTIES OF THE SOIL CAUSED BY SOIL TRAMPLING, EXPRESSED AS PERCENT OF THE CONTROL FENCED PLOTS

	Cove hardwood	Oak-hickory on slopes	Pine-oak on ridges
	Decrease—Percent		
Total porosity[1]			
0 to 2-inch depth	42[2]	15	6
2 to 4-inch depth	56[2]	12	4
Transmission (permeability)			
0 to 2-inch depth	70[2]	32[2]	13
2 to 4-inch depth	91[2]	32[2]	0
Infiltration (ring test)	91[2]	67[2]	—

[1]This is the total storage opportunity for water in the soil and includes both field moisture (capillary) and free moving (non-capillary) water.
[2]Statistically significant.

Trampling Effects on Physical Properties of the Soil

Contractors have found that the most efficient way to compact soil is with the sheep's foot roller. The repeated impact of cattle hooves produces a comparable result. Measurements after 8 years of use show that cattle trampling has had a pronounced effect on soil porosity. Transmission rates have been reduced and infiltration capacities diminished. These conclusions are based upon analysis of 120 soil samples of 250 cubic centimeters each, taken on the 34 randomly located sample plots. At each sampling spot two samples were taken at 2-inch depth and one at 2- to 4-inch depth. Laboratory analyses of the soil were made for total porosity and permeability by methods previously described.[4]

It is important to note that the 2- to 4-inch layer sustained more damage than the surface 2 inches (Table 1). This is caused by the fact that during the non-grazing period some loosening is brought about in the surface 2 inches each year by the alternate soil freezing and thawing during winter and spring months. No such frost loosening takes place in the subsurface layers, which are not effected by frost action in this locality.

Trampling effects on soil porosity in the oak-hickory type decrease with distance from the cove-hardwood type. Although more of the litter layer is present, compaction of the underlying soil has taken place. Reduction in litter cover is occurring, and it is apparent that with continued grazing the surface soil here will also show cumulative effects similar to those on the cove-hardwood type. There was even less change in soil porosity on the pitch pine-oak ridges, because cattle seldom visited the area.

[4]Hursh, C. R. and M. D. Hoover. Soil profile characteristics pertinent to hydrologic studies in the Southern Appalachians. Soil Science Soc. of Amer. Proc. 6:414-422. 1941.

Movement of Water

Movement of water into the soil has been slowed down by the compaction of the 4-inch layer in the upper horizon of cove hardwood soil. This decrease in hydraulic pathways through which water particles travel has resulted in 90 percent reduction in transmission. That is to say, whereas it took 30 seconds for a given quantity of water to move through the upper 4 inches of soil, 5 minutes are now required. It is a peculiarity of water's passage through soil that slight changes in shape and size of the hydraulic pathways cause large changes in transmission rates. On the experimental watershed, surface storm runoff water is now being produced by progressively smaller rates of rainfall. After 8 years of trampling, surface storm runoff flow is being observed on these slopes during high-intensity summer storms, as evidenced by litter dams, rilling, and exposure of plant roots and rocks. An illustration of the loss of infiltration capacity is furnished by a test frequently shown to visitors on the area. A 12-inch-diameter steel ring, 7 inches high, is driven into the ground 2 inches. Two quarts of water are poured into the cylinder. On the ungrazed plots the water disappears into the soil within 20 to 40 seconds. On the grazed plots where compaction has been greatest, water stands in the ring for 10 to 30 minutes or more.

Storm Peaks and Stream Turbidity Have Increased

Measurements made over the 9 years of observation show that accumulative effects of browsing and trampling are beginning to influence the quantity, timing, and quality of water that comes off the drainage area in storm periods. The change is illustrated in Figure 5.

During storms the stream comes up faster and reaches higher flood peaks. The stream is showing sharper breaks, rises, peaks, and recessions, which indicates that storm water is now flowing to the stream directly over the land surface. Actual observations on the watershed during rainstorms prove that this is the case. (Before grazing started, the area produced no overland storm runoff.) Naturally, storm peaks as shown in Figure 5 after 9 years of use are not yet so great as on woodlands in the locality that have been grazed for several decades, but the trend shows that this watershed is now also becoming a local flood source area.

In addition, stream turbidity is increasing. Formerly, only a dark tea color associated with a small amount of fine organic material was carried by this stream. In the ninth season of use, storm water for the first time carried clay material from exposed soil. Turbidity readings taken during one storm period in 1949 showed a maximum value of 107.5 parts per million on the woodland grazed area as compared with a maximum of 30.5 parts per million on adjacent ungrazed forested watersheds. Although the value of 107.5

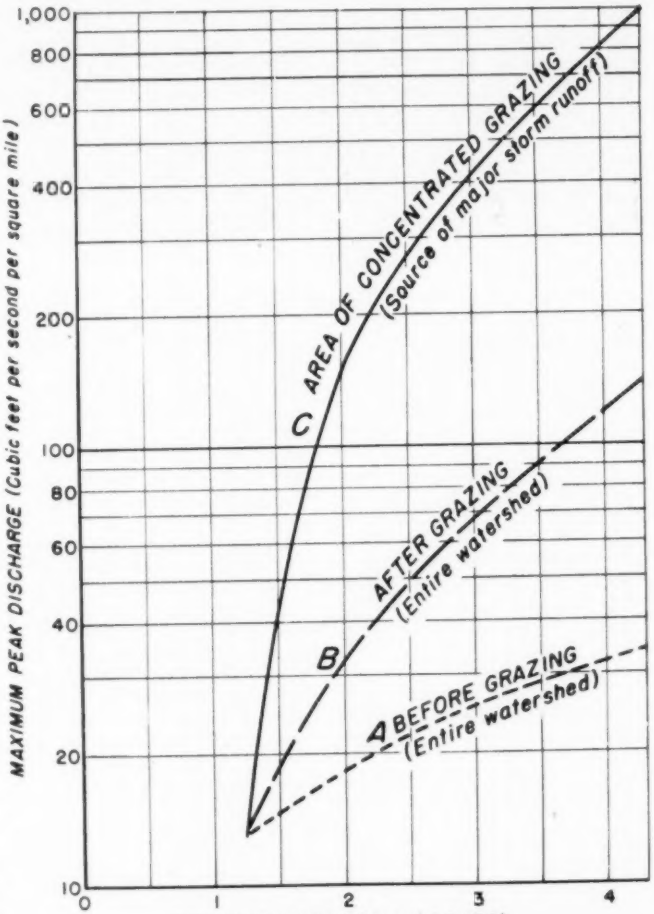

FIG. 5.—Comparison of storm peaks before and after grazing. Curves *A* and *B* are based on weir measurements. Because there is no weir installation for the concentrated grazing area alone, Curve *C* is based on estimated peaks derived from precipitation excess as determined from infiltration and percolation rates within the soil profile of that area. "Significant rainfall" is the amount of precipitation occurring between the time significant storm runoff begins and time when peak is reached.

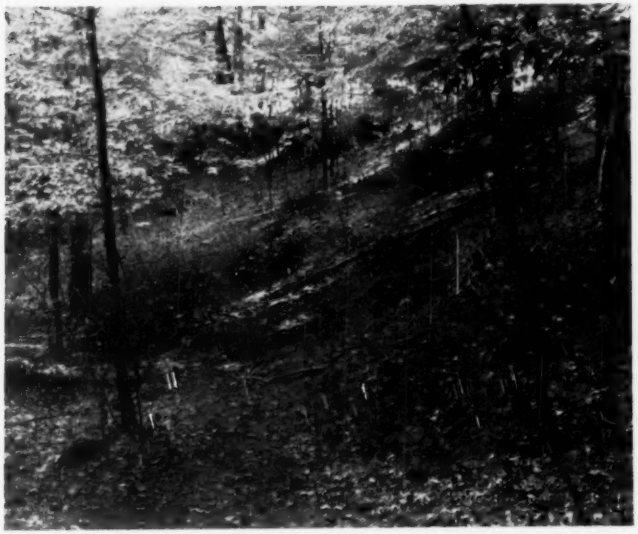

FIG. 6.—Six seasons of grazing in cove-hardwood type produced this park like characteristic appearance, with wind-strewn litter and absence of understory vegetation.

is low in contrast to values measured for water from adjacent farmed or poorly logged watersheds, it is in excess of the maximum allowable turbidity for municipal water specified by the U. S. Public Health Service. Each million gallons of water during the period of maximum storm peaks contained 400 pounds of soil. The effects have been gradual up to the present stage, but everything points to further increases in turbidity from this point on if the woodland grazing is continued.

Discussion

As a result of the combined changes on the watershed, even its appearance is changing. The reduction in ground cover plants gives the area the park-like characteristics shown in Figure 6. With fewer stems offering obstruction to movement, the litter is blown away to accumulate in ravines and ungrazed patches of laurel and rhododendron. The trampled portion of the watershed shows exposed soil for many months during the year. With the reduction in porosity and permeability, as well as in infiltration, the increased overland storm runoff is now producing obvious sheet erosion. Each year a progressively larger area is producing overland storm runoff and erosion. In the early years of the experiment, silt-laden overland flow did not reach the permanent stream flow channels. The reason was that such sediment as was washed off the bare soil areas was caught by litter in the depressions and ravines, so that clear water percolated into the soil. During the ninth season of grazing, however, a high intensity storm producing large volumes of overland flow scoured out most of the litter dams so that eroded sediment was carried directly to the stream channel. Subsequently, there occurred a sudden jump in stream turbidity during all storm periods. A continuous strip of bare soil now exists from the permanent stream channel to the storm runoff source areas. Had the area been burned annually, as is common practice on many grazed farm woodlands, the "scouring out" of litter dams and ravines would probably have taken place years earlier.

Prior to grazing, the water was of such quality that it would have needed no filtration for municipal use. Changes brought about by grazing have made the water unusable without treatment. Due to increased turbidities, processing of the water would now be necessary, and costs of such treatment would be 2 cents per thousand gallons.

It is difficult to assign precise money values to the losses in wood production caused by grazing on the experimental area. An approximation, however, may be helpful. Foresters estimate that good sites in the mountains will grow yellow-poplar at a rate of 200 board feet per acre per year. Since growth on these sites might be reduced approximately one-half, as indicated by this study, this means a loss of three dollars an acre a year at prevailing stumpage prices. Reduction in growth rates of other species are estimated at about 30 percent, and expected losses would have to be figured accordingly.

For the individual farm unit, it would probably be more profitable land management to clear and fence a small tract of woodland best suited to grazing and convert it to an improved pasture. One acre of improved pasture will provide more cow days of grazing than a hundred acres of woodland, judging by the Coweeta study. The question whether cattle can browse in a closed hardwood forest stand for a very short period of only a few weeks in the early spring without damage to soil, water, and tree growth still remains unanswered.

Under carefully controlled experimental tests at Coweeta, the progressive damaging effects of cattle on all land values were far more pronounced than originally had been conceived possible.

In considering facts and figures brought to light by this Coweeta study it must be remembered that the experiment was not typical, in that farmers usually have their cattle in an enclosure which includes both woods and fields, whereas the experimental watershed consisted of woods solely. The experiment was purposely designed to approximate in 9 or 10 years the cumulative effects that occur on typical grazed farm woodlands in perhaps 20 or 40 years. The essential point is that the cattle did not thrive, and that there was virtually no profit to balance against the extensive land damages.

Observations on Winter Drying of Conifers in the Adirondacks

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During the winter of 1947-48, unusual and extensive damage to coniferous foliage occurred throughout northern New York State as a result of winter drying. This article reports on observations and studies of this phenomenon made by the writers in the central Adirondacks during the past 3 years.

THE FIRST INDICATION of winter injury appeared early in March 1948, when needles of many conifers showed excessive browning. Whole mountain sides were covered with these discolored trees. Some of the more heavily damaged stands appeared as if scorched by fire. Trees with southern exposures were particularly affected, heaviest damage occurring along northern margins of roadways, power lines, rivers, swamps, and similar exposed locations.

Within a few weeks defoliation took place and the ground beneath the injured trees became covered with dead needles. The large numbers of brown and defoliated trees along the highways attracted public attention, and several newspapers and magazines commented on this condition. The majority of the writers concluded that the chief cause of the injury was the drought of the preceding autumn.

FIG. 1.—Injured red spruce on power line right-of-way, Paul Smith Experimental Forest. Note absence of injury on lower branches, which were protected by snow.

Our observations at the time showed that most of the injury occurred on the following species in decending order of severity: red spruce, hemlock, white pine, and balsam fir. Cedar, black spruce, white spruce, and red pine showed relatively little damage.

In general, damage to large trees occurred evenly throughout the length of the crown but the injury was confined chiefly to the south and southwest sides. Damage to small trees was particularly severe just above the snow line, indicating that reflection of sunlight from the snow had an injurious effect. Branches below the snow line showed no injury (Fig. 1).

Cause of Injury

The subject of winter-drying injury has received relatively little attention in the technical literature. Boyce[1] stated that desiccation is the chief cause of winter injury because damage usually occurs when periods of cold weather are followed by sudden increases in temperature, often accompanied by drying winds. Under these conditions, loss of water from the needles cannot be replaced because the soil moisture is frozen and is not available to the roots, or because the stem is frozen and fails to conduct the water upward. Shirley[2] stated that much of the so-called winter injury in evergreens, frequently attributed to freezing temperatures, is probably due to excessive desiccation caused by warm, bright days at a time when the soil is frozen, rather than to low temperatures.

[1]Boyce, John Shaw. Forest pathology. 600 pp., illus. McGraw Hill, New York and London. 1938.

[2]Shirley, H. L. Lethal high temperatures for conifers, and the cooling effect of transpiration. Jour. Agr. Res. 53: 239-258. 1936.

Climatic data for the fall and winter of 1947-48 offer some clues to the cause of this injury. Weather Bureau records show that October 1947 was the warmest October on record and the fourth driest, with only 60 percent of normal precipitation. November and December had subnormal temperatures but snowfall was 30 percent above normal. According to the *Annual Summary of Climatological Data*,[3] it was exceptionally cold from January 1 through the first 12 days of February, making the winter months of December, January, and February the coldest since the season of 1935-36. Precipitation during the first two months of the year averaged 30 percent below normal. These months were characterized by an unusual number of clear, bright days. Daily fluctuations in temperature were relatively great: night-time minimums were as low as—35 degrees F., and day-time maximums ranged as high as 35 degrees F. These fluctuations in temperature, with their resultant stimulation of transpiration, may have been a cause of the injury.

Since the greatest damage appeared on the south and southwest portions of the crowns, it seems plausible that the injury was caused by long periods of bright sunshine that raised surface temperatures and stimulated excessive transpiration from the needles, under conditions where replenishment from the frozen trunk was impossible.

Study of Injured Trees

In order to follow the reaction of injured trees, 50 sample specimens representing 6 species and various degrees of damage were selected in April 1948. Records taken on each tree included species, d.b.h., height, location, exposure, apparent

[3]United States Weather Bureau. Climatological data, New York. U. S. Dept. Com., Weather Bur. Ann. Sum. 1948, Vol. 40 No. 13. 1948.

FIG. 2.—This large red spruce has suffered severe crown damage as a result of winter injury.

vigor, and estimated percentage of needles injured. Two subsequent examinations were made on these trees—one in June 1948 and one in October 1949.

One species, red spruce, showed extensive bud injury associated with initial needle injury and defoliation. Bud injury in this species was estimated to be roughly proportional to the extent of defoliation. This type of injury resulted in death of twigs and branches (Fig. 2) and, in severe cases, the death of the trees (Fig. 3).

Twenty-five red spruce trees were studied. Of these, 10 showed initial defoliation of 75 percent or more, and none of the 10 recovered satisfactorily. Six were dead and the 4 living trees were apparently dying slowly at the last examination in October 1949. Of the other 15 red spruce, which showed moderate (25 to 75 percent) defoliation in April 1948, 7 were recovering at the 1949 examination, while 8 were in the doubtful class.

Balsam fir suffered less bud injury and made better recovery than did red spruce. Eight of 12 trees studied had severe (more than 75 percent) needle injury. One of these recovered well, 4 were in the doubtful class, and 3 had succumbed in October 1949. Of the two balsam fir trees showing moderate defoliation originally, one recovered well and one was in the doubtful class. Two trees of this species showing light (less than 25 percent) defoliation completely recovered.

One white pine showing heavy needle injury in April 1949 subsequently died. Three other trees of this species having moderate injury recovered fully within the subsequent 2 years.

Hemlock showed remarkable recovery. Of four heavily defoliated trees, all recovered as did one tree showing moderate defoliation.

These differences in recovery are apparently associated with species differences in the sensitivity of bud tissues to the phenomenon of winter drying. Red spruce buds are especially susceptible, while buds of balsam fir, although notably less sensitive, show moderate damage. Apparently buds of white pine and hemlock are both relatively well protected against desiccation of this type.

Growth of severely injured trees was greatly reduced during the 2 years following injury. Average diameter growth of living sample trees at breast height was 50 percent of preceding years. Uninjured control trees showed no significant reduction in growth over the same period.

Extent of Injury

Observations in softwood stands in the Adirondacks during subsequent years showed that bud injury was more extensive than was originally suspected. Permanent winter injury was not confused with suppression since in most cases winter-killed branches die from the tip back, while under normal suppression the twigs and branches die from the center of the stem outward (Fig. 4).

In February 1951, the extent of bud damage was measured on 20 randomly selected ¼-acre cruise plots on the Paul Smith Experimental Forest. Results showed that 46 percent of the entire coniferous stand has some form of permanent winter injury, although most of the trees were only lightly affected (Fig. 5). This study showed that 11 percent of the conifers had more than one-fourth of their crowns killed by winter drying. Approximately 2 percent of all trees, mainly the less vigorous members of the stand, were killed.

If we apply the growth-reduction data obtained from the 50 sample trees, the average merchantable stand of softwoods in the Adirondacks would show a 5-percent loss in growth during this period. Of more importance than this loss of growth in the merchantable stand is the heavy damage and death to small saplings. Because of exposure many understocked areas suffered the greatest damage, thereby further reducing the stocking of desirable softwoods.

FIG. 3.—A partially suppressed red spruce sapling killed by winter injury.

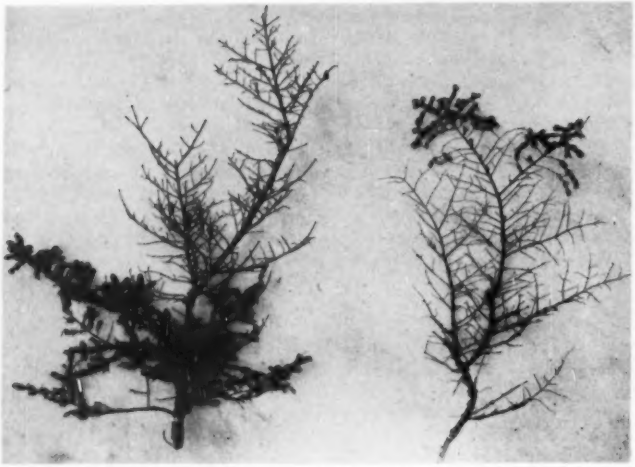

FIG. 4.—The effects of winter injury are easily distinguished from the effects of suppression. The dead tips on the branch to the left were caused by winter injury. The branch at the right has live tips, but inner twigs have died from suppression.

FIG. 5.—Dead branch tips on this small balsam fir indicate light, permanent winter injury. Such injuries reduce the growth of Adirondack softwood stands.

Relation to Forest Management

Although the heavy winter damage during the winter of 1947-48 was the most serious of its type on record in New York, mild forms of this injury appear nearly every winter. Recent observations have shown that trees moderately damaged in 1948 have been repeatedly injured during subsequent winters. In some cases the recurring needle and bud damage has been sufficient to cause the death of otherwise only moderately injured trees.

Winter drying must be recognized as a form of injury to coniferous stands in the Northeast to which red spruce is particularly sensitive. The nature of winter drying does not warrant control measures. Ordinary cultural measures resulting in vigorous stands will minimize the damage from this cause. This study indicates also that red spruce is liable to injury in locations with southwest exposure.

Summary

During the winter of 1947-48 severe winter injury of conifers occurred throughout New York State. In the Adirondacks, where these observations were made, the injury first appeared as a browning of needles; it was particularly severe on the southern and western portions of exposed trees. Limbs immediately above snow line were most severely affected. Browning and defoliation occurred on the following species in descending order of severity: red spruce, hemlock, white pine, and balsam fir. White cedar, black spruce, white spruce, and red pine showed relatively little damage.

Studies of trees with various degrees of browning and defoliation during the subsequent two growing seasons showed a differential response by species to similar degrees of initial injury. Red spruce showed severe permanent injury and death following heavy initial injury. Balsam fir showed considerably less permanent injury than red spruce, while most white pine and hemlock recovered rapidly. This differential response is explained by the extensive killing of the buds on red spruce and, to a lesser degree, on balsam fir.

Surveys of typical coniferous stands have shown that nearly 50 percent of all trees received some permanent injury. Approximately 10 percent of all trees had one-fourth or more of their crowns killed by this cause. Loss of growth from this cause in coniferous stands for the 2-year period is estimated at approximately 5 percent.

Correction

In the article, "A Rapid Method of Locating Contour Lines on a Topographic Map, JOURNAL OF FORESTRY, September 1951, page 645 and page 646, the horizontal distance shown in Case One should read "49 feet" (instead of "60 feet"). The contour interval should be expressed as "2 feet" (instead of "1 foot"). Thus the distance to the first contour line from the point of lowest elevation would be "7 feet", not "8 feet" as stated.

JAMES G. YOHO.

Compass Surveying Grows Up—The Compass-Theodolite Method of Economical Surveys

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EVEN to the general public it must be well-known today that the forester is a jack-of-all-trades. He is primarily a specialist in forest land management and timber utilization, but he must also know much more than a smattering of other trades such as firefighting, public relations, and surveying.

In his role as part-time surveyor there has been considerable improvement. Aerial photogrammetry today promises to take much of the work of his timber cruising and topographic mapping from the field and into the warm office where the blank spaces of maps can be filled in during inclement months. The various methods of photogrammetry are finding more and more practical uses in forestry and new techniques are being discovered each year—but none in any way eliminates the ground traverse or level line. In fact, they give another job to the forestry surveyor, the need for more accurate control points on the ground that can be identified on aerial photos.

In most cases the forester today can put aside the plane table, but he definitely needs more traverse and here he is hampered by three problems: the fact that this is a part-time job relegated to odd moments, that he needs increased accuracy, and that his ground surveys cover such a large amount of land (and difficult land) that it is usually economically impossible to survey them by the city or county surveyor's expensive cadastral methods.

A New Instrument and Method

There is now a new instrument in existence which gives a method of traversing that may supersede both those of the forester's compass and mountain transit. Most important, the method is efficient—radically reducing the cost of traverses without requiring the forester to learn a radically new method of surveying. This is the new compass-theodolite which has been designed expressly for forestry use. The instrument and its efficient method of running traverse deserve close inspection.

The name of the new instrument, which is the key to the method, is somewhat confusing for this is both a super compass (compass-theodolite) and a compass *and* a theodolite or transit. Basically, it is a small compact instrument using the principles of the latest optical geodetic theodolites to eliminate the eccentrical errors of a compass and to give easily-read magnetic angles to the accuracy of one minute. Also, by the flip of a lever, this instrument changes into a one-minute mountain transit.

For Traverses

The instrument's reason for being is to give modern accuracy and efficiency to the procedure of compass surveying. The advantages of a compass traverse for forestry surveys are well-known — the reason why the old surveying compass and the "Brunton" compass has been so popular in the past. One of the main advantages is the much more favorable law of error-propagation per station read, which is important on lengthy traverses and especially on the multi-stations and short tangents necessary in thickly-wooded lands. In other words, an error in reading a magnetic angle does not accumulate, does not affect the next station reading as it does in transit traverse. Thus on lengthy surveys the closure of the average compass traverse, despite its lesser accuracy per station reading, will be more precise than that with a one-minute transit unless the transitman moves with extreme slowness and extreme care. Another important advantage to all compass traverses is the much faster field progress, because of the reason mentioned above and because the magnetic-oriented instrument has only to be set up on every second traverse station. This latter advantage means a low-cost survey line. As the instrumentman "leapfrogs" past each foresight, he moves twice as far on each setup. As the setups are not over the foresights of the last stations, the instrument does not need to be centered over any particular point; it can be set down anywhere to establish a point that continues the traverse. The traverse can thus be run by only a two-man crew—the instrumentman and one assistant to place simple sights which do not have to be picked up later or moved aside for an instrument setup.

But there have been two serious disadvantages to compass traverses —the poor accuracy obtainable and the problem of local magnetic disturbances. These were formerly not too important, and compass traverses were widely used in the rough forest lands; but, today, with the mapping policy of the U.S. Forest Service calling for quadrangle sheets with a scale of 1 inch to 1 mile, with private timberlands becoming valuable tree farms, with accurate control points needed for photogrammetry, with roads, and the myriad of other forestry construction requiring cadastral-grade surveying, the forester has been gradually required to give up the advantages of this method and use the much more expensive transit traverse.

The so-called compass-theodolite method of running a traverse eliminates these defects and enhances the advantage of the compass traverse by a basic change in both the construction and principle of reading a compass. With the new instruments the speed of setup is extremely fast, in keeping with compass work, and there is no comparison in the accuracy obtained.

With ordinary surveying compasses, some improvements in accuracy were tried in the past by reading both ends of the needle through prisms and computing the average of the two readings. To the forester that slight gain in accuracy was completely canceled out because the method was

"clumsy." The prism system had to be aligned over the needle wherever the needle came to rest. To prevent parallex the readings had always to be taken on the needle from the direction it pointed, thus forcing the observer to be constantly moving around his tripod or—if in a hurry—to take an incorrect reading.

The compass-theodolite method gives an accurate and immediate magnetic angle by having a graduated circle attached to a strongly magnetized floating plate. There is no needle. Two readings on diametrically opposite parts of this circle are automatically combined and averaged by reflection through optical prisms and then are directly reduced to one-minute divisions by being passed through an optical micrometer in the same manner as micrometer readings are obtained down to 1/10 second on first order geodetic theodolites.

Roughly, the compass-theodolite method is that of an ordinary transit with the main circle (lower plate) replaced by a floating card compass. The instrumentman reads the whole degrees on the compass-circle, as on a transit, and obtains the fractions from an optical micrometer rather than a vernier which will not work satisfactorily on a floating plate. The instrumentman thus has a magnetic-reading instrument with a mean square error of one direction that amounts to approximately one minute, an accuracy that compares favorably with the mountain transit and far above the best surveying compasses which have a mean square error of approximately 1/10 degree. By the use of an optical micrometer, the readings have other advantages as well as preciseness —they cannot be misread, are obtained from the *sighting* position, are given instantly, and are given as simply as the mileage is given on a speedometer.

The elimination of the other defect to compass surveying—local magnetic disturbances—is thus overcome in a very simple manner. By going back to the comparison of the new method to that of a transit with a floating main circle, it can be seen that all that is necessary to change the instrument into a directional transit is to lock the magnetized floating circle to the base of the instrument. The instrumentman simply flips the "dampening" lever of the compass-theodolite. The lever is designed in a way that it locks the floating circle rigidly to the lower half of the instrument instead of to the usual glass cover—ergo he has a one-minute transit!

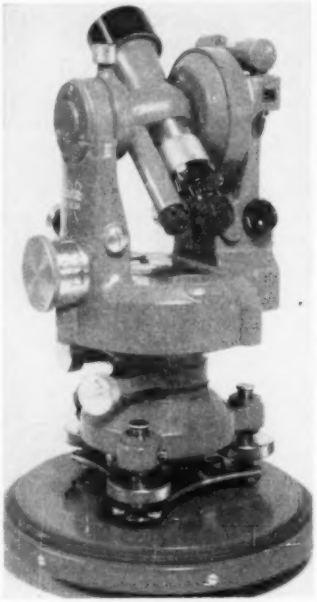

FIG. 1.—This is the compass theodolite. The instrument is only 8 inches high from bottom of base to top of level vial.

When in areas afflicted by magnetic disturbances, he simply changes over to the slower, but undisturbed, ordinary transit traverse. When in doubt as to his magnetic declination, he uses the instrument, as a transit, to take the simple morning or evening check on Polaris.

Used as a Transit

Used as a transit, the compass-theodolite gives one-minute readings of an accuracy equal to ordinary one-minute transits and therefore is a capable instrument for general construction and cadastral surveys. To make it such a universal instrument a vertical circle is, of course, incorporated; and this compact vertical circle, giving estimations to one minute, has the advantage of being read from an eyepiece alongside the telescope eyepiece as is done in the precise geodetic instruments. The compass-theodolite is very well suited to differential leveling, having an accurate level bubble mounted on the vertical circle frame instead of hidden underneath the telescope tube. In total, the compass-theodolite is as good as but no better than an ordinary transit for use on construction layout—it has the optical reading and fast movements of the precise geodetic theodolites, giving a station setup in half the ordinary time, but this is balanced out by the instrument's being a directional transit rather than a repetition transit, thus requiring slightly more computation in the note book when used on construction.

For its universal use as a one-minute transit, the instrument, of course, has the standard 1 to 100 stadia hairs in the telescope. The compact, highly-resolved, 16-power telescope also has the advantage of receiving the new Barot micrometer attachment, which improves the accuracy of stadia measurement 3½ times.

Therefore, when running a compass traverse the compass-theodolite man has in his hands the means of running an accurate stadia traverse measurement and a differential level line. This is a point that seems to have been completely overlooked in the past—the efficiency of running such lines together, that the procedure of running a compass traverse, "leap-frogging" as it is called, is exactly the same procedure that is used for stadia measuring and for differential leveling. Thus, the two-man compass crew can efficiently and in little extra time secure horizontal and vertical measurement, completely eliminating the need of chaining and leveling crews for placing control in the forest lands. In steep terrain (where many extra leveling setups would be necessary between traverse stations) the progress of the two-man compass-

theodite crew would be slow but would still be much more economical than that of bringing in leveling and chaining crews.

In this improved method of running ground forestry surveys the instrument is, of course, the key to the procedure and therefore its size and stability are important. The stability—resistance to shocks and weather—of the design of any optical-reading survey instrument is much greater than that of the conventional open-circle type, and is the reason why the optical instruments are being used so extensively in tropical and polar climates. In size, the optical instruments are compact. For instance, the optical geodetic theodolites which read directly to one second of a degree are smaller than a one-minute transit. The compass-theodolite design is the most compact of all. Its height is 8 inches, weight is 6 lbs., and length of telescope is only 4.3 inches.

The case for transporting the compass-theodolite is a small, cylindrical metal hood which fits down over the compass-theodolite and seals itself against a rubber ring on a baseplate. Thus the case is completely watertight and a pack horse could roll on it without harming it. To use the instrument the hood is lifted off, but the baseplate is not detached from the instrument but is the part that is screwed into the tripod. Therefore, when moving from one station to another, the instrumentman can simply slip the metal hood back on the instrument, even though it is on the tripod, and can carry it with complete safety over logs, across streams, or force it through brush.

All aspects of the compass-theodolite method seem practical, and such is always the need of the forester.

National Lumber Manufacturers Association Announces Its Third Annual Scholarship Program

The National Lumber Manufacturers Association has announced the initiation of the third annual competitive scholarship contest for students specializing in wood utilization or wood technology in forestary schools throughout the nation.

The faculties of each forestry school in the United States offering a bachelor's or graduate degree in wood utilization or wood technology will have the opportunity to nominate one student for a ten-week training program at the Research Laboratories of the Timber Engineering Company in Washington, D. C. The contest is predicated on a $1,600 lumber industry scholarship fund to be apportioned to four outstanding forestry students selected by the NLMA Committee on Awards on March 31, 1952.

The training period at the Teco Laboratory will extend from June 23, 1952 through August 29, 1952. The purpose of the program is to acquaint the scholarship winners with projects, problems, techniques, and methods in wood research and to provide them with the opportunity to work closely with experts in the field. Emphasis will be placed on gaining an understanding of the most important technical problems facing the lumber and wood-using industries.

To provide the broadest possible training experience, students are shifted from one project to another as the course progresses. Each student will work on an individual project for a period of time and then be transferred to another. Most of the work will be in close cooperation with members of the laboratory staff, but each student shall be responsible for one special project of his own. For this project, he shall be required to prepare a work plan, do the actual experimentation, and write a final report.

A few of the projects on which scholarship winners of the past have worked include the treating of railroad crossties, evaluation of adhesives, tests on doors, production of new types of core-panels, investigation of furniture defects, studies of the darkening of light furniture finishes, the development of hardboard from softwood pulp, methods for making sawdust-resin moldings, non-destructive testing of wood, and the development of a soil improver from wood waste.

Also included in the training courses in two previous years have been attendance at the Laboratory Glue School and the Milpak course. At the glue school, training was given in the evaluation of all types of adhesives, general considerations governing gluing wood, and the testing of glued products. The Milpak course taught the men how to manufacture refined lumber in bundled form from low grade hardwood boards. These courses are also valuable because they bring students into working contact with many men throughout the industry.

With two NLMA sponsored competitions behind them, lumber industry leaders are convinced that the program is a sound investment for the lumber industry and that this scholarship offers a real opportunity to help bridge the gap between the experimental level and the factory production line. The industry's ultimate goal in offering the scholarships is to be able to provide men who can help translate research findings into manufacturing realities—to supply a constant stream of technically trained new blood for the industry.

A Pattern of Scientific Inquiry for Applied Research

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EVER SINCE people started thinking they have expended effort on the solution of problems encountered in life; and almost as much effort on figuring out more effective ways to gain these solutions. This has led to the development of scientific inquiry: a complex system of thought and action that is employed by trained people as they attempt to solve their problems.

For a long time—perhaps up to John Stuart Mill—work on the methods of scientific inquiry was dominated by philosophers, who paid most of their attention to the metaphysical aspects of the subject. These methods became more and more formalized, until by Mill's time they were shaped into a well-organized pattern. Since then other philosophers and logicians have reformed and polished this pattern, so that it has assumed relatively perfect form in the writings of John Dewey and his contemporaries.

One feature of this kind of scientific method is striking to workers in applied research: The collection and analysis of factual data are quite subordinated to the philosophical processes. From a logician's viewpoint, most of the job of solving human problems lies in the mind of a trained person. Accordingly, his scientific method features the use of pure reason to evolve principles and to examine relationships among factors in the problem at hand; and it treats the collection and analysis of experimental evidence only as an incidental part of the scientific method.

This kind of approach opens rewarding avenues to knowledge; but it is not likely to supply a complete solution to practical problems. When he studies the conventional patterns of inquiry, the worker in applied research finds himself lost in a maze of unfamiliar language. The older literature on logic devotes attention to the intricate details of categorical argument, the character of induction, and the weaknesses of Mill's experimental methods; and recent writers seem to take delight in weaving a new and strange vocabulary, replacing the arguments of the classicists with the abstruse reasoning of a philosophical Gertrude Stein. And both earlier and current logicians enter only slightly into the earthy realm of empirical evidence, which a practical researcher requires to satisfy his customers in the farming or manufacturing world.

To meet this real need, investigators in the fields of applied research have turned away from the endeavors of pure logic. Instead they devote a major part of their attention to quantitative work, depending more on experimental data than on rational processes for the solution of problems. Perhaps they have gone too far in this direction. At least they have taken on a large additional burden, for the skilled use of the mind is a more streamlined way to attack problems than is the laborious collection and analysis of data.

Even so, the structure of quantitative scientific methods was not excessively complicated in fields like physics and chemistry, where the problems of natural variation are not ordinarily serious. But with the development of biological research, it became more necessary to sort out the effects of the variables being tested from all the sources of variation which could not be subjected to experimental control. Over the last half-century this has led to the growth of an intricate pattern of quantitative study, with its accent on skillfully designed experimentation. By now these techniques, employing mathematical statistics as their tools, have been developed to a high degree of perfection. As an inevitable result, present-day research workers are inclined to devote an excessive amount of attention to correlation analyses, designed experiments, and related procedures, and not nearly enough to the philosophical aspects of a complete scientific method.

In applied research there seems to be a need for these two schools of thought to be brought together into a single generalized pattern for scientific inquiry, combining the rapid techniques of logic with the solid facts of experimental evidence. While such an amalgamation does not contain original contributions to knowledge, perhaps it will supply the worker in applied research with more powerful weapons in his search for solutions to practical problems.

A suggested pattern for a scientific method of this kind is sketched below, under each of a series of topic headings. It will be evident that the successive headings represent formal steps in a research procedure. In solving any problem, however, not all of the steps may be necessary; some of the intermediate ones may be omitted. Where the problem is not very important or the solution is clearly provided by the experience of other workers, the steps of controlled experience and experiment may not be necessary; it may be possible to move directly from exploration to the solution of the problem and thence to the pilot project. But where human life, large expenditures of money, or a major change in natural-resource management depends on the correctness of the solution, the research worker may go through all these steps and even repeat some of them before he is willing to make a final recommendation. In any investigation the appropriate combination of research steps depends on the importance of decisions which rest on the solution of the problem, and on the degree of certainty which can be reached by any of the steps.

Setting Up the Problem

As a research worker approaches a problem to be solved, he has to define it in clear-cut terms. This

[1]Special thanks are extended to Joseph Pechanec and other staff members of this experiment station, for their constructive criticisms and suggestions.

is true whether he is starting from an indeterminate situation in a completely new field, or planning to sharpen up his knowledge on one aspect of a problem about which much is already known. In either case he has to specify the problem which he is to study, so that he can organize his thinking and action in the most efficient manner. Suppose a range-management researcher is concerned about improving the condition of deteriorated grassland in ponderosa pine forests of the western United States. Right there is stated a general research problem, but it is so broad in scope that it would be difficult for any research worker to get hold of it. The ponderosa pine zone extends from Mexico to Canada and from South Dakota to the Pacific Coast; and it is grazed by cattle, sheep, and big game in every season of the year. So the problem has first to be brought down to manageable size, by defining some aspect of it which can be attacked in a single piece of research. In this case, for example, the worker might state his specific problem to be the improvement of natural range vegetation in the ponderosa pine forests of the Blue Mountains in Oregon, through better grazing management.

When he has defined his special problem to any degree such as this, the research worker examines it to see whether a reasonable solution can be worked out with the resources of personnel, money, and land at his disposal. If not, he may have to circumscribe the problem even further; but otherwise he is ready to go ahead and develop an hypothesis to be tested. So he puts his feet on the desk and speculates on the variables which may have a bearing on the problem. In doing so, he reviews his experience with related problems on similar range lands, or even in other areas and climates; and he asks other workers in his own field of research what their experience has been. This includes a careful review of the results of previous research and observation.

Some of the classical tools of inquiry may be of value at this and other stages in the research technique. An adaptation of Mill's "method of agreement and difference" may, for example, help extend experience gained in other areas and climates to the range country of eastern Oregon. Suppose previous experiments have been conducted on ponderosa pine range land in the Rocky Mountains, with conclusive findings as to desirable methods of land management. Our research worker looks for similarities in the two areas: the composition of their range vegetation, and the character of the pine overstory; similarities in ordinary management and past history, in soil and topography and climate. Then, before he draws inferences as to his Blue Mountain problem, he makes equally detailed comparisons of differences between the two areas. The fact that the growing season of range vegetation in the central Rockies is characterized by frequent rains, whereas the Blue Mountains are much drier during this season, may have a profound influence on decisions as to good land management.

A variation of this technique is the method of analogy, which has gained increasing popularity in engineering research. The behavior of bodies moving in water or other fluids is found, for example, to be very much like their behavior in air—with easily recognized restrictions and adjustments associated with the differing effects of temperature, pressure, and viscosity. This similarity facilitates qualitative and even quantitative inferences on airfoil behavior, developed from observations in the denser fluids.

After he has gone through analyses like these our range worker may reason as follows: "The ponderosa pine range in the Blue Mountains of eastern Oregon is badly deteriorated, due to past and present overgrazing. Therefore reductions in grazing intensity should encourage recovery." This oversimplified statement of the relation may or may not be right. As an ecologist realizes, its correctness will depend on the degree to which the climax forage species have been eliminated by past overgrazing. If, as he may know from study of the areas involved, the remaining forage on large tracts of land consists only of annual weeds and other plants representing an early successional stage, reductions in grazing intensity could not accomplish recovery in any reasonable period of time. Then the research man abandons his idea of building up this kind of range land through management of natural vegetation. Instead he begins to delve into the possibilities of artificial revegetation through the seeding of desirable plant species. If, on the other hand, climax plants are still present in numbers sufficient to make recovery possible, he inquires whether it is simply overgrazing that has caused the trouble, or whether the seasonal timing of grazing use has had an important effect.

And so the worker goes on, using his mental capacities and experience to consider a number of variables associated with his problem. He picks up and rejects some and retains others, until finally he has organized the remaining variables into a small group whose manipulation promises a relatively high degree of success in attaining the solution of the problem. Then he is ready to formalize his thinking by stating a concrete hypothesis, definitely circumscribing the "population" to be used in testing it; and specifying how the results of his test may be used in the practical management of range land. The hypothesis might be expressed in terms like this: "Successful long-term management of pine range land, under conditions corresponding to those in the Blue Mountains of eastern Oregon, can be accomplished by reducing the use of forage by cattle to a point at which the climax species can build up in number and vigor until they dominate the general aspect of the range. This adjustment in use can best be accomplished by two means: cutting down the number of livestock, and avoiding any use during the spring months when the forage and soil are not ready to sustain the impact of livestock. Because the studies of timing and intensity of use will be relatively limited in area, the results will not be used directly to aid land man-

agers. Instead, they will assist in the planning of pilot projects elsewhere in the ponderosa pine zone, which will serve as more quantitative guides to land managers."

In a more elaborate form, this process of elucidating a problem may be built up into project or problem analyses, some of which may outline a whole series of related problems needing research in any given region and field of knowledge.

As you review these patterns of reasoning you will notice their use of the principle of the "calculated risk," commonly employed by military men and by civilians in ordinary life as well as by scientists. As the range investigator reviews possible leads and examines variables associated with his general problem, he consciously eliminates those which, in his judgment, are less likely to yield fruitful results. By this process he may close the door to avenues leading toward the best answer to his problem. But if he makes good use of judgment and experience, the odds against such an outcome are relatively large; and he insures, on the average, more certain returns from his investment in time and money devoted to research.

Testing the Hypothesis by Exploration

When the investigator has organized his thinking by analyzing the variables involved in his problem, setting up a formal hypothesis, and describing the limitations of its solution, he is ready to start solving the problem. One way to approach this job is by a process of exploration, part of which is like the mental processes used in defining the problem. Again, the research worker examines his own and other peoples' knowledge, making an exhaustive review of past work and publications. While doing so he is likely to find that a surprising amount is already known on problems like his. Occasionally the need for new research may even be eliminated: a sufficiently good solution can be worked out from available knowledge. If not, at least the information that has already been gained will assist the worker in further circumscribing the work which needs to be done in his own investigations.

During this preliminary exploration the investigator probably finds gaps in knowledge which can be filled without the need for formalized experimentation. In order to close these gaps he schedules trips to areas in which his particular problem exists, or in other ways searches for useful new information. Our range investigator goes into the ponderosa pine forests of the Blue Mountains, organizing his travel so that he can study range deterioration under a variety of conditions. He visits areas with different soils, elevations, and exposures, and he keeps track of variations from normal conditions, noting how they may have affected range succession and retrogression. As a result of this work, the researcher is able to build up a set of strong impressions as to desirable range management techniques.

It should be emphasized that observations by trained people form one of the most valuable tools of applied research. Compared to better controlled techniques, observation is relatively subjective. But it is a rapid and inexpensive way to acquire knowledge, and it offers maximum opportunity for the use of intelligence and judgment in attacking problems. Therefore this technique is useful not only in the preliminary stages of research, but as a valuable accessory to the most controlled kinds of experimentation.

In exploration, as in other phases of the scientific method, the ideas that are developed may call for adjusting or even completely revamping an hypothesis and its attendant reasoning processes. Variables originally considered important may not be worth retaining, or expected solutions may be found impractical. Hence the investigator needs to preserve flexibility in his attitudes, and to be ready to adjust his thinking whenever necessary.

These exploratory steps in research — perhaps even including the analysis of literature—might be called uncontrolled experience, in the sense that the information gained is not subjected to control by careful experimental planning. Experience of this kind formed the stock in trade of many earlier investigators, and it is still one of the most valuable assets of men doing applied research. As it is accumulated over the years, it generates a feel for what is right, and for the most profitable attack on any problem. Much knowledge has been gained through the use of uncontrolled experience without experiments; but it has sometimes led to the development of unsound beliefs, which have carried administrators and research workers into unproductive and often damaging by-lanes.

Guiding the way into these unfruitful paths are two weaknesses of experience. First, it is hard for even the most careful thinker to separate true experience from unconscious prejudice. Second, it may be equally hard to divorce the subject of investigation from the effects of all the variables that surround it. As the range investigator looks at the ponderosa pine zone, areas that he finds in good condition may easily have been the best land originally, where the most progressive and intelligent pioneers obtained ownership long ago. There the effects of good management may be confounded with the inherent potentialities of site and soil. Because of difficulties like these—perhaps more obscure but equally dangerous—the investigator knows that experience alone cannot be depended upon to tell the whole story; that he needs an unbiased test which will transform his hypothesis into relatively certain knowledge. This thought leads to the more quantitative steps in the scientific method.

It is at this stage, incidentally, that the worker in applied research ordinarily prepares a working plan for his further investigations. In doing so, he reviews all the impressions that have been acquired by reasoning, observation, and uncontrolled experience, and then lays out a detailed plan for new work in either of two directions. Of

these, the first can be called controlled experience; the second is the use of "designed" experiments.

Testing the Hypothesis by Controlled Experience

In this research technique, as in the observational part of exploratory studies, the investigator works with variables as they occur in nature. In our range management problem, for example, he goes into the ponderosa pine forests and studies the effects of past and present land use. But he subjects his observations to a higher degree of control—and makes his studies more expensive—through quantitative measurements of the variables involved in the problem. And he puts these measurements under further control by either or both of two general techniques: classification or correlation.

When the classification method is used, the investigator examines the population of variables which he wants to study, and sorts it into a number of discontinuous classes, each of which is relatively homogeneous with respect to the main variables to be examined. In testing a range-management hypothesis, the worker may find it profitable to select a varied sample of grazed areas in the ponderosa pine zone, and to classify them according to soil types, elevation, apparent productivity, and present condition. Then he will analyze the intensity of past and present grazing use on each of these strata, comparing these figures with data on the relative abundance and vigor of the desirable climax forage plants. Measurements of vegetation are necessarily taken on relatively small sample plots, distributed by some scheme of randomization and stratification. The purpose is to supply unbiased and representative sample averages for each of the important plant species on each of the land strata. From the results, comparisons among the strata may lead to inferences on the relation of livestock use to the development and survival of vegetation.

The correlation technique is obviously related to classification, in that quantitative measurements are taken in a number of places and under differing conditions, so as to supply a well-organized array of empirical evidence. Then the data on measured variables are subjected to simple or multiple correlation analyses, from which the necessary conclusions can be drawn.

In many cases the classification and correlation techniques can be combined for maximum efficiency. The population to be studied is first subdivided into discrete classes with respect to those variables that are not characterized by continuous variation. Differences in exposure or soil type, for example, fall naturally into clear-cut strata. At the same time measurements may be taken of other factors such as soil depth, forage volume production, intensity of use, and precipitation. These can be included in correlation analyses within the areal strata, and thus a large amount of information can be obtained from the study.

Still these investigations are subject to some of the same criticisms that were made of exploration techniques, however well organized and executed they may be. Personal biases can be largely removed by careful planning; but no matter how many subclasses a population is divided into, or how many variables are used in a multiple correlation analysis, the investigator is working with phenomena as they occur in nature. Thus he is still risking the possibility of both natural bias and the confounding of variables. As a result, even the most exhaustive investigations conducted by the methods of controlled experience require discretion and judgment by the investigator, as he weighs the chances of confounding and bias and interprets the results of his studies in terms of practical land management. These remaining risks obviously lead to the need for controlled experiments, in which bias and uncontrolled confounding of variables are removed as completely as possible through experimental design.

Testing the Hypothesis by Controlled Experiments

Developed partly as an outgrowth of correlation-analysis techniques, the procedures of controlled experimentation form the most unbiased and reliable, as well as the most expensive kind of quantitative research. Because of their relatively high cost, ordinarily controlled experiments should be resorted to only where simpler procedures have failed to provide satisfactory solutions, and where the expected results are sufficiently valuable to warrant the cost. From this viewpoint any investigator can think of numerous cases in which controlled experimentation has been overdone or unnecessarily applied. As a rule, in approaching any problem the research worker should first try to see how far he can get with simpler and cheaper techniques.

The principles of controlled experimentation are widely known and need not be discussed in detail here. But it may be commented that this research method has several objectives: to give each variable that is to be tested an equal chance to exert its effects, if any; to minimize extraneous variations which might obscure these effects, by the use of efficient experimental designs; and to provide unbiased estimates of both the effects being tested and the remaining uncontrolled variations, or experimental error.

In modern research techniques the first and third of these objectives are met through various processes of randomization and replication, accompanied by quantitative measurement of the variables involved. The second is attained by provision for both experimental and statistical control of variables that are not associated with the effects to be tested. By experimental control is meant the organization of experimental units, such as plots on range land, in such a way as to minimize extraneous variations. A simple example is the familiar randomized-block design which is used in field and laboratory research. A number of relatively homogeneous "blocks"—

tracts of land, or batches of experimental material—are chosen for experimental treatment within the general population to be studied. Each of these blocks is subdivided into smaller units—as plots — equal in number to the treatments that are to be investigated. Within each block the various treatments are assigned at random to these smaller units. Because all the treatments appear relatively close together within each block, extraneous variations like those due to differences in soil or exposure are reduced; and by randomization each treatment is given the same chance to exert its effects. Then the total variation in the experiment can be partitioned into that attributable to effects of the treatments; to variations among the blocks; and to the failure of the different treatments to behave alike in the different blocks.

Frequently the remaining uncontrolled variation in an experiment of this kind can be still further reduced by statistical control: the measurement and analysis of some of the variables that make up the experimental error. When this technique can be applied, it leads to the maximum amount of information which can be obtained from a designed experiment. A good example is the use of "past performance" as a concomitant variable in the analysis of experimental results. In a harvest-cutting study in a forest stand, for instance, the average growth rate of trees on each experimental plot for several years before treatment can be used to integrate all the complex of site factors that are associated with tree growth, except for the timber-cutting treatment itself. When pre-treatment growth is used to supply statistical control in a covariance analysis, it is commonly found that the remaining experimental error is considerably reduced. Other variables may also be chosen for this purpose; it is only important to make sure that they have no relation to the treatment itself.

This leads to one more interesting thought — the possibility of using variables that do have a relation to the treatments; not to reduce the uncontrolled experimental error, but to help explain the effects of the treatments. As an example, a study may be conducted to ascertain the effects of timber cutting or of heavy grazing on the infiltration capacities of the soil on watershed land. We may assume that such a study has been completed, and that statistically significant treatment effects were found. The precision of the experiment has already been built up to a satisfactory degree by experimental and statistical control. In addition, however, it is desired to estimate the effects, if any, of several factors which may have been associated with the effect of vegetation removal on infiltration of water into the soil. In order to find out, when the experiment was conducted measurements were made of these variables, including the volume of plant litter and humus on the surface of the mineral soil. Through a covariance analysis of experimental results, this particular factor was found to be significantly related to the variations in infiltration induced by the experimental treatments.

The scrutiny and interpretation of explanatory data play an extremely important role in applied biological research, as they do in other aspects of science. Often, as a worker seeks for explanations of natural phenomena or of experimental effects, his search will lead him deep into the realm of "fundamental" research. This is entirely appropriate, as long as his inquiry or his more abstract research bears a direct relation to the testing of his original hypothesis. Although administrators frown at him, there is even a place in applied research for the sound scientist who spends all of his time delving into the uncharted courses of true fundamental research. But such freedom should not be misused. In general, a safe guiding rule for the worker in applied research is to start with a clear-cut hypothesis which points toward the solution of a practical problem; to keep his inquiries directed toward that solution; but not to hesitate to explore any branching paths of fundamental research which, by the calculated-risk principle, offer a fair chance of helping him to arrive at a usable answer.

The Experimental Solution

When the research worker has completed his investigation, whether by observation, experience, or experiment, he has either verified his hypothesis or failed to do so. If he failed, there may have been one or more of several reasons. Perhaps he had not acquired the background necessary to pick the most promising treatments; or perhaps there simply were not any treatments that would yield usable results. Techniques employed or concomitant variables selected may have been inadequate to express the real effects of treatment or relationships among variables. Chemical soil analyses, for instance, may by no means express the real relation of mineral nutrients to plant growth; or data on total storm precipitation may be poorly related to flash-flood discharges. Or it may easily be that the experiment was not efficient enough to make the treatment effects stand out above the experimental error. These troubles are all common enough so that they deserve careful attention; one of the secrets of successful research lies in the design and execution of suitably efficient experiments.

Even if the hypothesis was verified, it was only in relative terms. As in ordinary life, the results of the investigation have simply led the worker to a conclusion or decision, which may be either right or wrong. In order to assist him in judging its correctness, he sets up various probability levels which serve to suggest the chance that the solution may be wrong. If the results of the investigation are not very vital, the investigator may choose to work against relatively low odds. But if the penalties of a bad decision are likely to be severe, he will ordinarily require a higher level of probability against such an eventuality. Then he will set up a more precisely controlled set of tests or a larger number of them, or he will demand a larger

measured effect of treatments before it is judged significant. With such a background of skillful planning, the investigator has real cause for satisfaction when experimental results stand out clearly above experimental errors.

In any case, when an experiment has been concluded it will generally have exposed new problems or interesting variables, some of which may be considered more important than the subject of the original tests. This may call for more experiments, or it may mean resuming the faster paths of logic, exploration, and experience. Using these tools as far as possible the investigator goes on, adding more new impressions to the facts gained from his experiment, until he needs to resort to quantative tests again.

Extension of the Solution

In applied biological research especially, the investigator has to work with an extremely varied population under changing climatic and economic conditions. On his route toward an experimental solution he tries to encompass this variation as thoroughly as possible by the combination of exploration, experience, and experiment in an efficient pattern of inquiry. Even so, he cannot often cover a substantial part of the population, and some of his experiments must necessarily be artificial or small in scale. Consequently, experimental findings can seldom be recommended for practical application before they are tested by means of pilot projects, to see how usable they are and how widely they can be applied.

Ordinarily pilot projects should be carried out first under conditions similar to those of the experimental solution, but on a more practical scale. The study units in a pilot project may have to be large in size, and it is desirable to have administrative people or land managers as well as research workers take part in laying them out and conducting the investigations. In forest areas, for example, such a project may include one or more logging units in a timber sale; on range land the units are large enough so that livestock can be handled in a natural manner. Then, if no hitches in procedure develop from this larger-scale application, similar projects may be set up on sites or materials differing from the original experiments. Timber-cutting pilot projects may be replicated on widely different areas in the same general forest type, so as to show how recommended treatments may vary in their effects under different environmental conditions.

The results of such pilot projects do not change the validity of an experimental solution, within the limits prescribed by the original hypothesis and experimental procedures. But they may demonstrate that the solution is not practical when tried out on a larger scale or under different conditions. Then further investigations must be directed toward reorientation of the solution or reformulation of the hypothesis, with any necessary movement back through a part or all of the steps of scientific inquiry.

Like other parts of the general pattern, the pilot-project step may sometimes be omitted; or it may be reached directly from logical analyses or exploratory work, without recourse to the more detailed and expensive processes of controlled experience and experiment.

The Pattern in Review

In the preceding discussions we have gone through a complex pattern of inquiry which is particularly intended for use in applied research. None of the steps are new in themselves; if there is anything intriguing in this presentation, it is the interweaving of these techniques into a single, organized scientific method, with logic, exploration, experience, and experiment assuming their proper places. This, it would seem, is an efficient way to do research. The steps may be contracted or expanded, but the pattern remains the same. Like a mountaineer, the research worker looks over his task and plans a practical route. Secured by the protecting rope of training, he moves rapidly up over the rocky obstacles until he feels unduly exposed—especially if the footholds of his observations seem a little shaky. Then he stops and drives a spike, fastening himself to the cliff with the firm anchor of a quantitative experiment. And so he proceeds upward, keeping just the right balance between climbing and anchoring. If he anchors too often, all his time is consumed in driving spikes—or making statistical analyses—and he may never reach the summit. But if he climbs too fast and far between anchor points, sooner or later he will fall. For the mountain climber or the research worker, the first course means lack of progress; the second may be fatal.

Symposium on Southern Pine Management

A symposium on the management of young, even-aged stands of southern pine will be held at the Louisiana State University, Baton Rouge, on March 13 and 14. Interested land owners, managers, and foresters are invited to attend. Notify A. B. Crow, School of Forestry, Louisiana State University, Baton Rouge 3, of attendance, so accommodations can be arranged.

The Vegetative Propagation of Hemlock[1]

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IT HAS BEEN SHOWN[2,3] that the common or Canada hemlock, *Tsuga canadensis* (L.) Carr. may be propagated by cuttings and that the rooting of the cuttings is usually improved by treatment with a root-inducing substance.

In the present work, special attention is given to (a) the relationship of rooting to the age of wood from which cuttings are made, (b) the effects of fungicides and root-inducing substances used for the treatment of cuttings, (c) season of year or stage of growth at which cuttings are taken, and (d) clonal differences or differences in rooting ability of cuttings from various trees.

At various times from August to January, cuttings were taken from different trees.[4] In most cases, cuttings were treated with root-inducing substances (indolebutyric acid or a-naphthaleneacetic acid) applied by the solution-immersion method, the bases of the cuttings being immersed in water solutions of the root-inducing substances for some hours. It was found that cuttings totally immersed in solutions of indolebutyric acid (100 to 150 milligrams per liter for 18 to 24 hours) did not root as well as did cuttings which had only their basal ends immersed. Only basal treatment was applied in the work summarized in the tables. In some cases, powder-dip treatments were applied to cuttings, with or without previous solution-immersion treatments. In all cases cuttings were treated immediately before setting them in the rooting medium (a mixture of two parts sand and one part peat) in a greenhouse bench without bottom heat.

Rooting was usually completed within 6 months. The percentages[5] of cuttings which rooted are recorded in Tables 1, 2, 3, and 4.

TABLE 1.—EFFECTS OF TREATMENT WITH ROOT-INDUCING SUBSTANCES ON ROOTING OF CUTTINGS OF *T. caroliniana* AND *T. sieboldii*

Species	Time of taking cuttings	Treatments of cuttings	Percent of cuttings which rooted
T. caroliniana	August 16	Untreated	5.0
		Hormodin No. 2	71.2
		Hormodin No. 3	100.0
T. caroliniana	October 10	Untreated	25.7
		Indolebutyric acid 200 mg./l., 22 hr.	70.6
T. caroliniana	December 1	Untreated	16.4
		Indolebutyric acid 200 mg./l., 22 hr.	64.3
T. Sieboldii	November 10	Untreated	10.7
		Indolebutyric acid 100 mg./l., 22 hr.	50.0

TABLE 2.—EFFECT OF AGE OF WOOD ON THE ROOTING OF CUTTINGS

Date of taking cuttings	Treatments of hemlock cuttings	Percent which rooted: Wood 1 year old	Wood 2 years old	Wood 3 years old
December 17	Untreated	42.5	23.7	23.7
	Indolebutyric acid 100 mg./l., 24 hr.	80.2	60.9	51.2
	Indolebutyric acid 200 mg./l., 16 hr.	80.6	80.2	50.0
	Hormodin No. 3	70.0	60.9	51.2
January 13	Untreated	0.0	0.0	—
	Indolebutyric acid 100 mg./l., 4 hr.	47.0	20.4	—
	Naphthaleneacetic acid 50 mg./l., 4 hr.	87.5	53.3	—
	Naphthaleneacetic acid 100 mg./l., 1 hr.	40.2	27.1	—

Work With Species Other Than Tsuga canadensis

As is shown in Table 1, cuttings of Carolina hemlock, *Tsuga caroliniana* Engelm., taken in August, October and December, rooted poorly without treatment, but most of them rooted after treatment with indolebutyric acid 200 milligrams per liter, for 22 hours, or with Hormodin No. 2 or No. 3.[6]

November cuttings of *Tsuga sieboldii* Carr. rooted poorly without treatment, but 50 percent rooted after treatment with indolebutyric acid 100 milligrams per liter for 22 hours.

Thimann and Delisle[7] obtained similar results with cuttings of Japanese hemlock, *Tsuga diversifolia* Mast. Untreated cuttings rooted poorly. Best rooting (43 percent) was obtained with cuttings taken in December, rather than August or March, and treated with auxin 100 or 200 milligrams per liter for 24 hours.

Work With Tsuga canadensis

In most of this work, cuttings were made with the basal cut at the base of the most recent season's growth — wood not more than 1 year old. It is thus possible to obtain the greatest number of cuttings from a given amount of ma-

[1] Massachusetts Agricultural Experiment Station Contribution No. 803.

[2] Doran, William L. The propagation of some trees and shrubs by cuttings. Mass. Agr. Expt. Sta. Bul. 382. 1941.

[3] Doran, William L. Propagation of hemlock by cuttings. American Nurseryman 74:18-19. 1941.

[4] Some of the cuttings were collected and sent to the writer by Dr. John C. Swartley, an authority on the forms of hemlocks.

[5] These are the percentages of cuttings which had rooted when all or most unrooted cuttings had died. The numbers which rooted subsequently were not large enough to affect conclusions arrived at earlier.

[6] Hormodin No. 2 and Hormodin No. 3 contain, respectively, 3 mg. and 8 mg. indolebutyric acid per gm. talc.

[7] Thimann, Kenneth V. and Albert L. Delisle. Notes on the rooting of some conifers from cuttings. Jour. Arnold Arboretum 23:103-109. 1942.

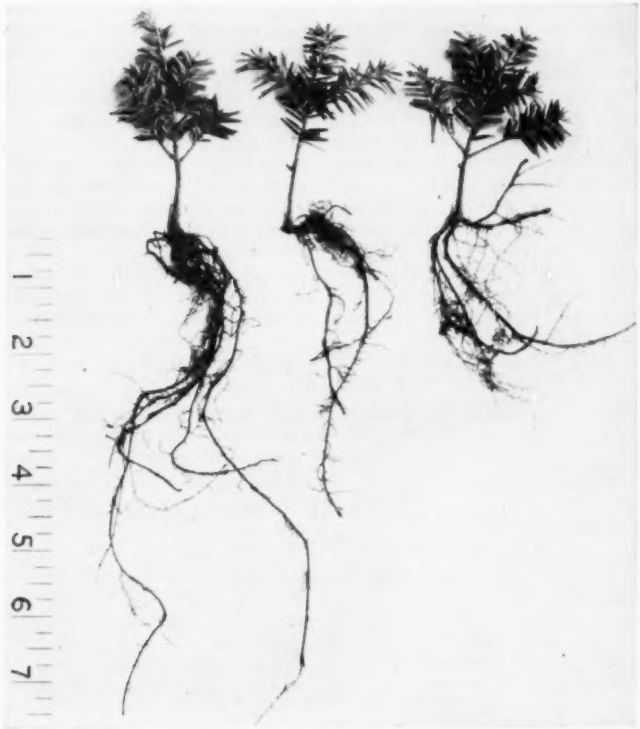

FIG. 1.—Rooted cuttings of hemlock wintered in greenhouse and photographed 1 year after cuttings were taken.

terial. Such cuttings, taken from more slowly growing trees, may be too small to set easily. Cuttings from these trees may be made with the basal cut at the base of wood in its second or third year. Rooted cuttings of that type are illustrated in Figure 1.

The rooting of cuttings made from wood 1, 2, or 3 years old is recorded in Table 2. Treated cuttings taken December 17 began to root 38 days earlier than the untreated ones, and rooting was completed in 186 days.

All treatments increased the percentages of rooting. With or without treatments, cuttings of 3-year-old wood rooted in smaller percentages than cuttings made from 2-year-old wood or from wood in its first year, and treated cuttings made from 3-year-old wood rooted in smaller percentages than did cuttings of 2-year-old wood.

Treated cuttings taken January 13 rooted in larger percentages if made from wood in its first year than if made from wood in its second year (Table 2).

These results indicate that if material for cuttings is not abundant and if the new growth is long enough, wood in its first year is to be preferred for hemlock cuttings. But if material for cuttings is abundant, wood 2 or 3 years old may be used. Such cuttings root in smaller percentages but may be easier to set in the rooting medium and may make a rooted cutting of a given size in less time than do cuttings made from wood less than 1 year old.

It should be noted that Thimann and Delisle[7] found that the age of hemlock trees from which cuttings are taken had no effect on the rooting of cuttings. These investigators found that the rooting ability of cuttings of hemlock may, however, vary from clone to clone; this same variation was noted in work reported in Table 3. In this table are recorded the results with hemlock cuttings taken from different trees between September 28 and January 21 and treated with root-inducing substances.

Untreated cuttings rooted poorly or not at all; best rooting without treatment was only 37.6 percent. This was true also of untreated cuttings in other instances. (Table 2), in which the best rooting without treatment was 42.5 percent.

Cuttings of hemlock from different trees responded in varying degrees to solution-immersion treatments with indolebutyric acid or a-napthhaleneacetic acid or to powder-dip treatments with Hormodin No. 3. The powder-dip treatment gave excellent results with cuttings taken December 17 (Table 2) but was somewhat less effective than indolebutyric acid applied by the solution-immersion method to cuttings taken on November 13 and January 21 (Table 3).

Treatments resulting in marked increases in percentages of cuttings which rooted (Tables 2 and 3) were indolebutyric acid 100 milligrams per liter, 16 to 24 hours; indolebutyric acid 200 milligrams per liter, 4 to 16 hours; and a-naphthaleneacetic acid 50 milligrams per liter, 4 to 16 hours. Within these limits the exact number of hours did not seem important, and the treatments now being used by the writer are indolebutyric acid 100 milligrams per liter, 20 hours; indolebutyric acid 200 milligrams per liter, 10 hours; or a-naphthaleneacetic acid 50 milligrams per liter, 10 hours.

Cuttings rooted less well if, after treatment with indolebutyric acid and before insertion in the rooting medium, their basal ends were dipped in puddled clay.

The rooting of cuttings of hemlock was not improved by treatment with indolepropionic acid 25 to 100 milligrams per liter, 20 hours; 2,4,5-trichlorphenoxyacetic acid 0.5 milligrams per gram talc; or potassium nitrate 50 or 100 milligrams per liter, 18 to 24 hours.

Swartley[1] considers February to be the best month in which to take cuttings of hemlock if a greenhouse bench with bottom heat is available. But in the work done here, using no bottom heat, there was satisfactory rooting of treated cuttings, at least from some trees, when cuttings were taken between mid-August and late January.

In studying the effects of fungicides on the rooting of cuttings of hemlock, the cuttings were first treated with indolebutyric acid or a-naphthaleneacetic acid applied by the solution-immersion method. Following this treatment, some of the cuttings received powder-dip treatments with the fungicides either alone or variously diluted, by weight in all cases, with talc or with Hormodin No. 3.

Cuttings of hemlock were injured by the fungicide Spergon (96 percent tetrachloro-para-benzoquinone), wettable Spergon (48 percent tetrachloro-para-benzoquinone), Semesan Jr. (1 percent ethyl mercury phosphate), and ceresan 2% (2 percent ethyl mercury phosphate). Rooting was not improved by Arasan (50 percent tetramethyl thiuramdisulfide).

Results with Phygon XL (50 percent 2,3-dichloro-1,4-naphthoquinone) are recorded in Table 4. Cuttings taken December 18 rooted in larger percentages if treated with Phygon XL alone than if not treated. Indolebutyric acid 100 milligrams per liter, 18 hours, followed by treatment with Phygon XL improved rooting more than did indolebutyric acid 100 milligrams per liter, 18 hours, alone.

Cuttings taken December 20 rooted 37.1 percent without treatment, 51.4 percent with indolebutyric acid 200 milligrams per liter, 4 hours, and 82.9 or 85.7 percent after solution-immersion treatment with indolebutyric acid 200 milligrams per liter, 4 hours, followed by powder-dip treatments with Phygon XL-talc 1:1, 1:2 or 1:4.

Although differences were not as great with cuttings taken January 16, such cuttings rooted in larger percentages if given powder-dip treatments with Phygon XL-Hormodin No. 3, 1:1, 1:2 or 1:4, or with Phygon XL-talc 1:4, following solution-immersion treatments with a-naphthaleneacetic acid or indolebutyric acid, than if treated with a-napthaleneacetic acid or indolebutyric acid alone.

Improved rooting of cuttings following their supplementary treatment with Phygon XL-Hormodin No. 3 does not necessarily result from the action of the fungicide, for Hormodin No. 3 contains a root-inducing substance.

But rooting was also improved by Phygon XL and Phygon XL-talc 1:1, 1:2 or 1:4, and particularly by the latter two, used as powder-dip treatments after treatments with indolebutyric acid in solution. There is no added root-inducing substance here, and it seems fair to attribute the greater survival and improved rooting of cuttings to the action of 2,3-dichloro-1,4-naphthoquinone alone.

[1]Swartley, John C. Directions for rooting and growing of hemlock cuttings. The Hemlock Arboretum. Bul. No. 69, 1950.

TABLE 3.—EFFECTS OF TREATMENTS WITH ROOT-INDUCING SUBSTANCES ON ROOTING OF CUTTINGS OF HEMLOCK

Time of year at which cuttings were taken	Treatments of cuttings	Percent of cuttings which rooted
September 28	Untreated	0.0
	Indolebutyric acid 100 mg./l., 24 hr.	33.3
September 28	Untreated	0.0
	Indolebutyric acid 100 mg./l., 24 hr.	68.1
September 28	Untreated	13.0
	Indolebutyric acid 200 mg./l., 4 hr.	72.7
	Indolebutyric acid 200 mg./l., 8 hr.	60.9
	Naphthaleneacetic acid 50 mg./l., 4 hr.	72.3
	Naphthaleneacetic acid 50 mg./l., 8 hr.	64.5
September 28	Untreated	0.0
	Naphthaleneacetic acid 50 mg./l., 8 hr	37.4
October 2	Untreated	0.0
	Indolebutyric acid 100 mg./l., 18 hr.	40.5
	Naphthaleneacetic acid 50 mg./l., 18 hr.	65.6
October 14	Untreated	1.5
	Indolebutyric acid 100 mg./l., 18 hr.	33.8
	Indolebutyric acid 200 mg./l., 18 hr.	41.7
October 29	Untreated	0.0
	Indolebutyric acid 100 mg./l., 18 hr.	17.3
	Indolebutyric acid 200 mg./l., 6 hr.	30.2
	Naphthaleneacetic acid 50 mg./l., 16 hr.	23.3
November 10	Untreated	0.0
	Indolebutyric acid 200 mg./l., 18 hr.	32.5
November 13	Untreated	0.0
	Indolebutyric acid 100 mg./l., 16 hr.	80.1
	Indolebutyric acid 200 mg./l., 16 hr.	80.1
	Naphthaleneacetic acid 50 mg./l., 8 hr.	75.5
	Naphthaleneacetic acid 50 mg./l., 16 hr.	75.9
	Hormodin No. 3	50.6
November 26	Untreated	8.7
	Indolebutyric acid 150 mg./l., 20 hr.	78.3
December 10	Untreated	1.6
	Indolebutyric acid 150 mg./l., 20 hr.	68.3
	Naphthaleneacetic acid 50 mg./l., 20 hr.	88.2
December 11	Untreated	15.3
	Indolebutyric acid 100 mg./l., 20 hr.	70.8
	Hormodin No. 3	98.4
January 7	Untreated	12.5
	Indolebutyric acid 100 mg./l., 24 hr.	50.0
January 13	Untreated	0.0
	Indolebutyric acid 200 mg./l., 4 hr.	67.0
	Naphthaleneacetic acid 100 mg./l., 3 hr.	73.6
January 16	Untreated	17.1
	Indolebutyric acid 100 mg./l., 24 hr.	80.0
	Hormodin No. 3	54.3
January 21	Untreated	37.6
	Indolebutyric acid 100 mg./l., 24 hr.	88.4
	Hormodin No. 3	65.4

Summary

Cuttings of *Tsuga canadensis* rooted in larger percentages if made from wood in its first year than if made from wood in its sec-

ond or third year. Cuttings of the latter type, however, may be more convenient to use than first-year wood when dealing with slower growing trees.

Untreated cuttings rooted relatively poorly; that is, usually in low percentages. Percentages of cuttings which rooted were usually markedly increased by treatment with indolebutyric acid 100 milligrams per litter for 16 to 24 hours; indolebutyric acid 200 milligrams per liter for 4 to 16 hours; and a-naphthaleneacetic acid 50 milligrams per liter for 4 hours.

There was, in most cases, satisfactory rooting of treated cuttings taken from mid-August to late January, but cuttings from all trees were not equally responsive.

Percentages of cuttings which rooted were increased by powder-dip treatment with the fungicide Phygon XL (50 percent 2,3-dichloro-1,4-naphthoquinone). This chemical was effective when used alone or diluted with tale or Hormodin 1:1, 1:2 or 1:4, after solution-immersion treatments with indolebutyric acid or a-naphthaleneacetic acid. Certain other fungicides, similarly used, were not effective.

TABLE 4.—EFFECTS OF FUNGICIDAL AND ROOT-INDUCING TREATMENTS ON THE ROOTING OF CUTTINGS

Date of taking cuttings	Treatments of cuttings	Percent of cuttings which rooted	
December 18		In 122 days	In 186 days
	Untreated	4.3	6.5
	Indolebutyric acid 100 mg./l., 10 hr.	26.1	34.8
	Indolebutyric acid 100 mg./l., 18 hr. followed by Phygon XL	39.2	50.0
	Phygon XL alone	17.4	21.7
		In 85 days	In 148 days
December 20	Untreated	2.9	37.1
	Indolebutyric acid 200 mg./l., 4 hr.	34.2	51.4
	Indolebutyric acid 200 mg./l., 4 hr., followed by Phygon XL-tale 1:1	71.4	82.9
	Indolebutyric acid 200 mg./l., 4 hr., followed by Phygon XL-tale 1:2	65.7	85.7
	Indolebutyric acid 200 mg./l., 4 hr., followed by Phygon XL-tale 1:4	59.0	85.7
		In 90 days	In 185 days
January 16	Untreated	0.0	17.1
	Naphthaleneacetic acid 100 mg./l., 3 hr.	45.6	65.7
	Naphthaleneacetic acid 100 mg./l., 3 hr., followed by Phygon XL-Hormodin No. 3, 1:2	62.9	80.0
	Naphthaleneacetic acid 50 mg./l., 16 hr.	37.1	77.2
	Naphthaleneacetic acid 50 mg./l., 16 hr., followed by Phygon XL-tale 1:4	60.0	82.8
	Indolebutyric acid 200 mg./l., 4 hr.	14.3	60.0
	Indolebutyric acid 200 mg./l., 4 hr., followed by Phygon XL-Hormodin No. 3, 1:1	37.2	68.6
	Indolebutyric acid 200 mg./l., 4 hr., followed by Phygon XL-Hormodin No. 3, 1:4	51.3	74.3

Rooting of cuttings of Carolina hemlock was also improved by treatment with indolebutyric acid.

The Changing Forest Flora of the Ozarks

A report on the first time-lapse study of the forest flora of the northern Ozarks, founded upon actual observations of the same site over a 10-year period, appears in the *Annals of the Missouri Botanical Garden* 38:283-291, September 1951. The authors, August P. Beilmann and Louis G. Brenner, manager and assistant manager, respectively, of the Missouri Botanical Garden Arboretum, in their article, "The Changing Forest Flora of the Ozarks," provide the basis for a better understanding of forest tree succession in the region.

Considerable attention has been given to both the rocks and the soils, since these have been observed to play important roles in the distribution of certain tree associations which may obtain only in similar areas. The history of land use of the area is reviewed, since the activities of man, in his pursuit of a livelihood in forestry and agriculture, may have altered the natural succession of forest trees.

This time-lapse study indicates a rapid invasion of valuable timber species such as red oak, white oak, and white hickory. The black jack oak-post oak, and white oak-sugar maple associations have been invaded by these vigorous species and will be dominated by them, indicating a future invaluable source of high-grade timber species in this area.

Notes

Consistency in Sweetness and Flow of Maple Sap

There is great variation in the quantity and quality of maple sap from year to year, sugar bush to sugar bush, and even from day to day during the season. Many maple producers have noted that some trees produce more sap than others, year after year. Recent research, in Vermont[1] and Ohio[2] as well as in New York, has also demonstrated that certain trees consistently give sweeter sap than others. This holds true throughout the season and year after year. For the same amount of sap, these sweet trees produce more sirup or sugar at less cost.

Methods

Former personnel of the Geneva Agricultural Experiment Station made complete measurements of sap quantity and quality for 5 years in a sugar bush near Geneva, N. Y.[3] This sugar bush lay on nearly flat land and had not been tapped for at least 10 years prior to experimental use. Tapping was done on all sides of the trees, approximately one-fourth of the trees being tapped in each cardinal direction each year. Thirty-nine trees, selected at random for this study, include 27 one-bucket trees (10-15 inches d.b.h.), 4 two-bucket trees (15-20 inches d.b.h.), 4 three-bucket trees (20-25 inches d.b.h.), and 4 four-bucket trees (over 25 inches d.b.h.). The number of quarts of sap for each tap hole, tree, and run was measured; at the same time the sugar concentration (soluble solids as sugar) of the sap was measured by means of a Carl Zeiss hand refractometer.

[1]Taylor, F. H. Variations in sugar yield in maples in natural stands. Paper presented at Conference on Maple Products, Philadelphia, 1950.

[2]W. R. Anderson, J. S. Ball, H. R. Moore, and Richard Baker. Factors influencing yield and cost of maple syrup. Farm and Home Research, Ohio Agric. Exp. Sta. 34:10-12. 1949.

[3]Tressler, C. J. and W. I. Zimmerman. Three years' operations of an experimental sugar bush. N. Y. State Agric. Exp. Sta. Bul. No. 699. Geneva. 1942.

TABLE 1.—SUGAR PERCENTAGE AND SAP YIELD OF SELECTED TREES

Tree No.	Sugar percentage 1939	1940	1941	1942	1943	Rank of trees in sugar percentage by tree numbers 1939	1940	1941	1942	1943
1	2.3	3.1	3.1	2.6	2.9	2	2	4	4	2
2	2.8	3.6	3.2	3.1	3.2	4	4	2	2	4
3	2.5	3.0	2.6	2.7	2.6	3	1	1	3[1]	1
4	2.6	3.5	3.6	3.4	3.9	1	3	6	1	3
5	2.2	2.4	2.5	2.2	2.4	5	7	3	7	6
6	2.0	2.7	2.7	1.9	2.5	7	6	5	5	5
7	2.1	2.8	2.3	2.4	2.2	6	5	7	6	7

Tree No.	Total sap — quarts per tap hole 1939	1940	1941	1942	1943	Rank of trees in quarts of sap by tree numbers 1939	1940	1941	1942	1943
A	74	41	44	43	44	F	G	G	B	F
B	60	54	54	55	46	E	E	F	F	B
C	62	33	40	28	39	A	B	B	G	A
D	52	23	29	28	28	G	F	E	A	G
E	85	60	45	28	39	C	A	A	C	C } Tie
F	87	50	61	52	47	B	C	C	D	Tie E }
G	67	64	63	47	41	D	D	D	E	D

Results

Table 1 shows examples of sugar percentage and sap yield of several trees selected at random.

All 27 one-bucket trees were ranked in descending order of their average sugar percentage for the 5-year period. The 12 two-, three-, and four-bucket trees were ranked likewise. Then the same procedure was followed with regard to amount of sap. The results are shown in Table 2.

Little correlation was found between the amount of sap produced and the sugar concentration.

A sweet tree tends to remain a sweet tree, while a big producer tends to remain a big producer. Ordinarily, more variation might be expected in sap quantity than sweetness since there is the possibility of human error in tapping a little too close to an old tap hole or some hidden defect. Of course, trees in exposed positions are subject to much variation in sap quantity according to the whims of the weather.

An Aid in Thinning Sugar Bushes

Many sugar bushes are in need of thinning to give the better trees more room to grow. All the wood removed is often needed for boiling sap. A sap hydrometer, which measures sugar percent when set

TABLE 2.—COMPARISON OF SUGAR PERCENT AND SAP YIELD FOR ONE-BUCKET AND MULTIPLE-BUCKET TAPPING

Number of times in five years that sugar percent of 27 one-bucket trees ranked in the

	Highest fourth	In between	Lowest fourth
9 best trees	24[1]	19[1]	1[1]
9 medium trees	7	24	10
9 poorest trees	0	23	21

Number of times in five years that sugar percent of 12 multiple-bucket trees ranked in the

	Highest fourth	In between	Lowest fourth
4 best trees	14	6	0
4 medium trees	0	14	4
4 poorest trees	0	6	9

Number of times in five years that total sap per bucket of 27 one-bucket trees ranked in the

	Highest fourth	In between	Lowest fourth
9 best trees	21	22	1
9 medium trees	9	25	10
9 poorest trees	1	20	20

Number of times in five years that total sap per bucket of 12 multiple-bucket trees ranked in the

	Highest fourth	In between	Lowest fourth
4 best trees	11	8	0
4 medium trees	3	12	1
4 poorest trees	0	6	12

[1]Since a few trees were measured for only four years, these numbers do not total 45.

in a bucket of stirred sap, may be used to aid in selecting the poorer trees for removal. Such an instrument costs slightly over a dollar.

It is recommended: (1) Amount and sweetness of sap should be determined near the middle of the season. The amount of sap varies somewhat with the size of the tree and side tapped in early and late season.[3] Sugar percent readings are not too reliable in late season. (2) Trees to be compared should be measured on the same day since the amount and sweetness often change from day to day. (3) In order to be sure of which trees are the poorest, measurements should be made twice a season for three years. However, even one measurement in one year points out the good and the poor trees fairly accurately. It's far better than none at all.

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Forest and Forest Land Taxation

Governor Wolcott of Connecticut said in a message to his state legislature: "Timber and woodland may also be considered as capital of which the interest and profits are deferred for periods of 20 to 100 years. If taxed annually the rates ought to have reference to the remote periods at which the income will be received. It being certain that an excess taxation would accelerate the destruction of timber and wood and would occasion runious mischief."

A similar message might well be addressed to his state legislature by any governor interested in forest taxation. He might even use exactly the same phraseology, though the element of time differed somewhat; Governor Wolcott spoke in 1819. Despite remedial tax laws by many states, almost no really workable forest tax law is on the statute books of any state in the Union 132 years later. Too many people have felt and still feel that death, weather, and taxes are three things we can talk at great length about. They believe that all three are inevitable and there is nothing that can be done to change them. However, within current times medical science has done a great deal about extending the normal life expectancy of man. We are also doing something about the weather, so much so that certain states are contemplating passage of laws to control, or prevent, "rainmakers" seeding the clouds with dry ice, or silver iodide crystals, to encourage precipitation. Now Richard F. Bickford, forester for Lewis County, Washington proposes to do something about the assessment of timber and wild lands within the county.

The residents of the county show a lively interest in forest, and forest land taxation since forest land comprises the major portion of the county. Recent surveys indicate that Lewis County has more merchantable timber than any other county in the State of Washington. Many sawmills are located within the county, operating for the most part in second-growth stands. The larger old growth, high grade logs are processed outside the county.

In Lewis County it is proposed that the assessment of land and of timber be segregated, with allowance being made for the fundamental differences which exist between forest land which is intermingled with farm land and forest land areas which contain no farm lands or potential farm lands within their perimeters.

Many factors entered into the determination of a base rate for assessment purposes. For example, the land in the western portion of the county is more accessible and closer to market than is land in the more remote and steeply broken topography of the eastern areas. Location within the county, present or potential use of the land, presence of timber and age and species of timber were also factors used in determining the assessed values.

Assessment of land intermingled with farm land.—Such land will have a base rate determined by its location within the county and other factors already enumerated. The county was divided into three zones and a base rate was established for each zone as follows:

1. Land in ranges 4-11 East is valued at ..... $1.50 per acre
2. Land in ranges 1 to 3 is valued at ..... 2.00 per acre
3. Land in the Western ranges is valued at ..... 2.50 per acre

The following factors will increase the base values by the indicated amounts.

a. Potential agricultural land will increase values $2.00 per acre.
b. Land used for pasture will have increased values to $2.00 per acre.
c. Land that is located along a country road or adjacent to agricultural land will increase values by $1.00 per acre.
d. Medium stocking of trees 10-25 years old (3 to 7 inches d.b.h.) will increase value $2.50 per acre.
e. Medium stocking of trees 25-40 years old (8 to 12 inches) will increase value by $7.50 per acre.

Assessment of lands which contain no farm lands or potential farm lands within their perimeters.—The base rate for all forest lands which are not intermingled with farm lands is set at $1.00 per acre. The following conditions will increase the base value:

a. Medium stocking of trees 10-25 years old (3.0 to 7.9 inches d.b.h.) will increase value by $2.50 per acre.
b. Medium stocking of trees 25-40 years old (8 to 12 inches d.b.h.) will increase value by $7.50 per acre.

Under the Bickford assessment method the value of merchantable timber will be treated as a separate problem. All timber will be classified on the basis of diameter. Trees over 30 inches d.b.h., will be assessed as large timber. Trees less than 30 inches, d.b.h., will be assessed as small timber. For assessment of merchantable timber the county has been subdivided into four zones based on accessibility.

Zone I includes timber which is readily available for cutting within five years of date of assessment.

Zone II includes timber which will probably be cut within five or ten years after assessment.

Zone III includes timber which will probably be logged ten to twenty years after assessment.

Zone IV includes timber which will probably be logged more than twenty years after assessment.

The following rates per thousand boardfeet, Scribner rule, will be established for each zone:

Zone	Major species Large timber	Minor species Small timber
I	$2.50	$1.50
II	1.50	1.10
III	1.10	0.80
IV	0.80	0.55

The general property tax to date has not imposed an undue burden upon owners of mature timber. When applied to logged-over lands and young (no income) second growth the general property tax has stirred up an ever growing chorus of complaints. Annual interest and tax payments on a forest yielding no annual income is the greatest obstacle to sustained yield under private management. It is to be hoped that this new approach to the problem results in a more equitable adjustment of the tax on lands dedicated to growing trees as a crop. It could also act as an incentive to better forestry practices in the management of forest lands in the west.

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Sulfuric Acid Increases Yield of Gum in Ponderosa Pine

In the summer of 1951 a small test experiment was conducted at the Institute of Forest Genetics to test the effect of treating ponderosa pine turpentine faces with sulfuric acid. Split faces, 6 inches wide, were made on four trees having diameters of about 24 inches. The intact strip of bark between the faces was 8 inches wide. On each tree one face was treated with 40 percent sulfuric acid after the method developed by the Forest Service at Lake City, Fla. (The acid spraying bottle was supplied by the Lake City branch of the Southeastern Forest Experiment Station.) The other face was chipped without application of the acid and thus served as a control. The trees were tapped May 10, 17, and 31; June 19, July 10, and 30; that is, six times, and the final collection of gum was made August 13.

FIG. 1.—Yield of gum by ponderosa pine; *right*, untreated face; *left*, face treated with 40 percent sulfuric acid.

The total amount of gum from the four acid-treated faces was 4.27 pounds, while the control faces yielded 3.07 pounds of gum. In other words, the four treated faces yielded more than a pound of extra gum. The average yield per streak was 4.4 ounces from the treated faces and 3.2 ounces from the untreated faces (Fig. 1). This little test, subject to confirmation by statistically designed experiment, suggests that sulfuric acid treatment increases gum flow of ponderosa pine considerably.

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Growth of Residual Longleaf Pine in Southern Mississippi

When the virgin longleaf pine (*Pinus palustris* Mill.) near McNeill, Miss., was clearcut in the winter of 1902-03, the loggers left behind scattered trees too small and suppressed to be worth taking. Recently 50 such trees were felled and their performance for the past 47 years was analyzed. The results corroborate findings elsewhere[1] that residual longleaf may be expected to recover after being released.

The trees were 32 to 81 years old—the average was 58 years—at a 1-foot stump when released, considerably younger than the merchantable trees that had been suppressing them. They averaged 5.3 inches in stump diameter inside bark (about 5 inches d.b.h., outside bark) and ranged from 2 inches to 8. While no records exist, survival appears to have been good despite the severe ice and wind storms of recent years—about ten trees per acre survived until 1949.

In the first 10 years after release, the trees built up crowns large enough to seed the area with a fairly well-stocked stand. Ultimately, they increased in d.b.h. at rates from about 2.5 to 3.5 inches in 10 years. Those less than 4.5 inches in stump diameter at release attained the fastest rate of growth in the shortest time (less than 20 years). Larger trees reached a somewhat lower peak growth rate after nearly 25 years and declined thereafter. By the 30th year after release all the trees had slowed down, possibly because they now had to compete with their own progeny. In general, the trees smallest in diameter before release had the best diameter growth after release. This was probably because the trees that were most badly suppressed were also the youngest and therefore had the youthful vigor to make the best response to release.

Figure 1 shows the periodic diameter growth inside bark at a 1-foot stump, for three sizes of tree. To aid interpretation, d.i.b. growth may be multiplied by 8/7 to get diameter growth outside bark. D.b.h. classes roughly corresponding to the given stump d.i.b. classes are 2.3 to 4.8 inches; 4.8 to 6.2 inches; and 6.2 to 8.5 inches.

When the trees were cut in 1949,

[1] Chapman, H. H. and R. Bulchis. Increased growth of longleaf pine seed trees at Urania, La., after release cutting. Jour. Forestry 38:722-26. 1940.

Barrett, L. I. Increased growth of longleaf pine left after logging. South. Lumberman 135(1751):39-40. 1929.

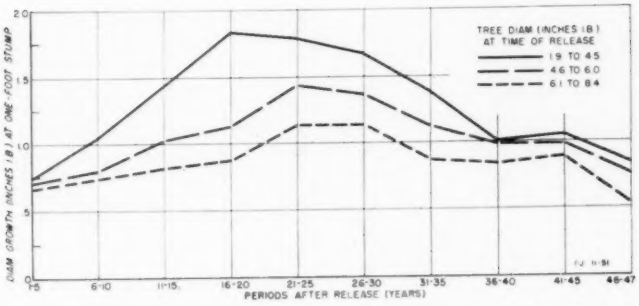

FIG. 1.—Mean diameter growth for three size classes of released virgin longleaf pines. Basis: 14 to 20 trees in each size class.

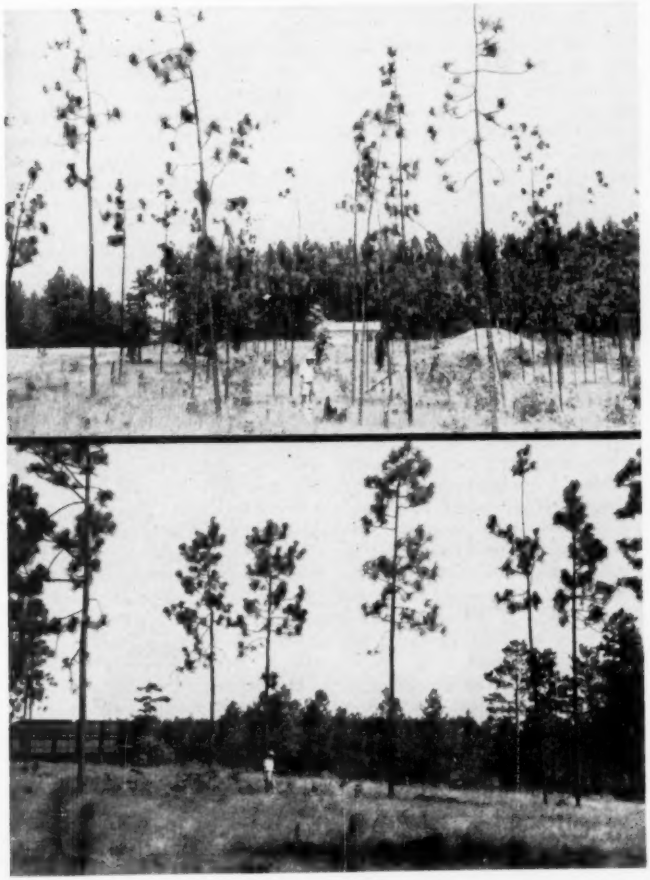

FIG. 2.—Suppressed longleaf pines usually recover after being released. *Top*, residual second-growth longleaf in south Mississippi in 1949, shortly after area was clearcut for pulpwood. *Bottom*, similar trees 8 years after release.

their average d.b.h. (outside bark) was 14.7 inches. Their total height averaged 63 feet, of which a 45-foot portion was merchantable for sawlogs. Forty-five percent of the total height was in crown. The boles were free of defect, and early crowding had left them smooth and clean. Nearly all the trees yielded high-grade sawlogs. The average volume was 180 board feet per tree by the International ¼-inch rule.

To see if second-growth longleaf responds to release in the same way, an examination was made of several recently logged stands on similar sites in south Mississippi. Figure 2A shows one such stand after logging—there are 15 to 25 stunted, whiplike residuals per acre, too small for pulpwood. Figure 2B shows a similar stand 8 years after release. For the 5 years prior to release, stump d.i.b. in the stand in Figure 2B increased only 0.6 inch. For the 5 years after release, it increased 1.3 inches. Because suppression had not shortened their crowns as severely, these second-growth pines recovered much more rapidly after release than did the virgin residuals.

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The Meylan Pruning Saw

The saw has been quite generally accepted as the most satisfactory tool for forest pruning in the Northeast. It is slower than an axe or a club, especially on dead and brittle branches. It does not make as smooth a cut as do edged tools or clippers. But it is accurate, cuts close to the tree trunk without injuring it. The saw requires only ordinary skill to use reasonably well and does not unduly tire the worker. Besides, almost everyone knows how to operate one.

A wide variety of patterns and sizes of pruning saws have been tried: thick blades and thin, single and double-edged, straight and curved, push stroke and pull, fine-

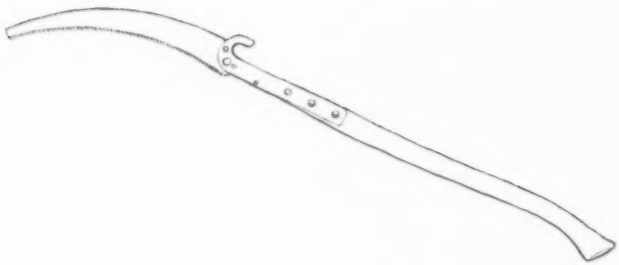

FIG. 1.—The Meylan Pruning Saw.

toothed and coarse; even bow-saws. Handles may be D-, pistol-grip, or pole. Weights vary from half a pound to more than two pounds. The saw used on any one project seems to be more a matter of availability, personal preference, or local custom than of calculated choice.

In 1947, Gustave J. Meylan of Cortland, N. Y., forest general foreman on the staff of District Forester James D. Kennedy, was in charge of a large field crew engaged in pruning softwood plantations. In the course of this work, he developed, from materials at hand, the saw that now bears his name. Although assembled from standard parts and quite similar in appearance to certain other saws, the weight, balance, and shape of handle make it a uniquely efficient tool.

The Meylan Saw is a Bartlett No. 44 polesaw head with a 16-inch, 8-point curved blade, mounted on a single-bit axe handle. An extra hole is drilled through head and blade and a bolt inserted to keep the blade in fixed position. The weight is only 2 pounds, the overall length 46 inches, although it can be made up to 50 inches for men with long arms. This seemingly simple combination has certain advantages over other saws used for forest pruning.

Head and blades are stock items obtainable from the Bartlett Mfg. Co. of Detroit. (Essentially similar parts are available from other manufacturers.) Interchangeable blades of other patterns are also available.

Actual assembling is simple and easy. Handles are available in several lengths, to suit individual taste.

Blades can be quickly removed for filing; reserve blades are easily carried in the field.

The saw is light in weight and handy. Since it can be used with either or both hands as occasion requires, it is definitely less fatiguing than a one-hand saw. When occasion requires, a man can use his whole weight, from the ankles up, instead of only one arm. Some workers are able to sever 1-inch limbs with only one or two strokes. It is easy to place the narrow blade into proper position and to make a close, clean cut, even in densely branched trees like spruce.

The relatively long handle permits the worker to reach into tangles of branches without having to break his way into the trunk. This reduces accidents and wear and tear on clothing. It also lets a man reach into a tree and shake out snow and dead needles.

With the Meylan saw, an average-sized man can reach to the ground without stooping and to 9½ feet without stretching. Considering that the same man, equipped with a handsaw can reach only to 7 feet, this saw increases by almost half the length of stem that can be pruned from the ground, which is the cheapest segment of the pruning job.

The shank of the head and the lower part of the saw are stiff and stout enough to be used to knock off small, dry twigs such as are found along the internodes of spruce and larch, thus saving the trouble of sawing them.

Using the saw as a pitchfork, to move or pile cut limbs, saves stooping and unproductive work.

While a straight pole of similar length could be used, it is the familiar grip of the axe handle, and particularly the calfsfoot, that makes the Meylan saw an exceptional tool.

A confirmed handsaw and ladder man, I was introduced to this new saw by Meylan shortly after it was developed. It took only one day's work in my own plantations to convince me of its merits. Since then, I have pruned several thousand pine, spruce, and larch, and like the Meylan saw better each time. Teeth coarser than 8-point are satisfactory for pine but not for species with more and finer branches, especially spruce.

Ordinarily, plantations are pruned in three steps—to 7 feet, from 7 to 12 feet, and from 12 to 17 feet. The Meylan saw permits the first step and half of the second step to be done from the ground. It has been estimated that the use of this saw will reduce the cost of low pruning in coniferous plantations by 15 to 25 percent.

On February 15, 1950, the New York State Employees' Merit Award Board granted Meylan a Certificate of Meritorious Service for his work on this saw.

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Points of View

How Will You Have Your Water?

If you live in the Willamette Valley of Oregon you get 20,000,000-acre-feet of water in the average year. How will you have the water flooding out your winter wheat, washing out your bridges, wrecking your salmon spawing grounds, loading your river channels with sediment? But first, do you have any choice? This question is being investigated by the U. S. Corps of Engineers and the U. S. Department of Agriculture as a part of their flood control investigations in the Columbia Basin. The Corps has recommended and built some dams to help cut down the flows; the Department of Agriculture has been investigating what land management can do to minimize the floods.

Before any of the land investigations could be completed and the results made known, two articles appeared in print claiming that logging has no influence on floods. One article by A. W. Priaulx, director of public relations for the West Coast Lumbermen's Association, was published in the *Oregonian* of July 8, 1951; another by E. H. MacDaniels, consulting forester, was published in the October 1951, JOURNAL OF FORESTRY (pages 742-3). Both articles report MacDaniel's study of the streamflow of the Willamette River, Oregon. The articles would seem to nourish the antagonistic philosophies of two minority groups: the ultra-conservationists who believe in absolute preservation of the forest and the ill-advised loggers who think of nothing but the logs. These are fast-disappearing philosophies. Most people interested in timber resources now recognize both the trees—as a crop to be harvested—and the forest as a source of water and therefore subject to management for water control.

As water is becoming an increasingly important factor in the economic development of the western states, questions relating to water control and management will increasingly be raised. Such questions will inevitably touch some tender spots. Just as Priaulx and MacDaniels were quick to vouch for the innocence of logging, so will others rush to defend farming practices, grazing use, road building standards, etc. But water investigations are not questioning whether forests should be harvested, or land farmed, or roads built. Rather, they ask, "How can these activities be carried out with the least damage and the most benefits to the land, the water, and the people depending on them?"

A first step in getting the answer is to determine whether past activities have had appreciable adverse effects on water. MacDaniels studied a single watershed, the Willamette River above Albany, Ore. Changes in the forests of this watershed were rather small for several decades before 1942. Only 10 percent of the area was logged in the previous 30-year period. After 1942, flood peaks were partly controlled by the new Fern Ridge and Cottage Grove Reservoirs. Under such conditions a more sensitive method than tallying mean annual floods by decades is needed to detect logging effects.

A better method is to compare the flood peaks of the Willamette with those of an unlogged watershed, to see what changes in floods have occurred and get a rough idea of the magnitude of the changes. The McKenzie River at McKenzie Bridge can be taken as a suitable unlogged watershed. Since the average relationship of the peak discharges from the two watersheds was found to be linear and the trend passes through zero, simple ratios of discharges may be used in making a comparison. Such a comparison is shown in Table 1.

TABLE 1.—COMPARISON OF PEAK DISCHARGES, WILLAMETTE AND MCKENZIE RIVERS

Period	Mean annual maximum discharge		
	Willamette River	McKenzie River	Ratio W/M
	Cubic feet per second		
1920-34	105,100	7,400	12.20/1
1935-41	73,100	3,970	18.41/1
1942-48	136,600	8,530	16.01/1

The ratio of the peak discharges of the Willamette River to those of the McKenzie River was 14.20 for the 1920-34 period and increased to 18.41 in the 1935-41 period; hence, the indicated increase in peaks of the Willamette River is 30 percent. After the reservoirs were installed, the peaks of the Willamette were 16.01 times those of the McKenzie so they were still 13 percent greater than in the 1920-34 period. These increases in peaks were associated with increases in the logging; however, logging itself is not the best measure of the effect. What logging does and not the amount of logging was found to be more important. According to statistical analysis of peak discharges from 24 Willamette Basin watersheds, the effects of logging were a minimum where logging was followed by the best restocking of the logged area. In three watersheds where forest age and stocking improved progressively during the period of the discharge record, the flood peaks correspondingly decreased.

Studies are indicating that you do have a choice as to how you will have your water. Reservoirs can control some of the excess flow and good restocking after logging gives additional water control. Past logging in the Willamette Basin has resulted in about this natural restocking: 25 percent nonstocked, 20 percent poorly stocked, 40 percent medium stocked, and 15 percent well stocked. The water managers are confident that something *can* be done to improve on that record.

HENRY W. ANDERSON,
California Forest and Range Experiment Station,
U. S. Forest Service.

Approved (?) Logging Technique

For weeks now the September issue has been lying where I would be sure to see its provocative cover picture, entitled *Approved Technique in Douglas-fir Logging, Olympic National Forest, Washington.* It is a picture of ten men viewing a piece of virgin forest that is clearly in the first stage of being destroyed by the so-called block system of cutting. It shows three areas which have been utterly devastated. The rest presumably is left for similar devastation a little later under the "approved" technique of staggered settings.

I write to inquire why the JOURNAL uses the word "approved" in the title it gives this picture of destructive logging? Has our professional forestry society ever taken any action to approve such shameful destruction? If not, by what right does the JOURNAL lend itself to the purposes of those who are trying to convince the public that this kind of destruction ought to be condoned and even labelled conservation?[1]

There must be many foresters and woodsmen—I know quite a number myself—who know in their bones that this kind of rape of the greatest softwood forest in the world is wrong and unnecessary. Although it may beget natural reproduction it will convert the northwest from a large-log to a small-log economy. Not only the region but the whole world will be the poorer for it.

Is American ingenuity so bankrupt that it cannot develop practical ways of putting this last great virgin forest under productive management for a sustained yield of big logs instead of converting it so destructively and wastefully to small-log forestry? Surely, there are many who believe that practical foresters and woodsmen, if they put their heads, hands and hearts to it, could devise feasible ways of logging lightly and frequently over the whole forest—thereby preserving the cake and eating it too, just as Nature does.

One is reminded of Stephen Vincent Benet's ringing lines in his *Ode to Walt Whitman:* "Gouging the hills for gold, laying waste the timber . . . they have wasted the pasture and the fresh valley . . . to build sham castles for imitation Medici."

And one shudders at the day's news and its grim portents. He can sense America as Whitman sensed it. He can believe in her because she guarantees the right of a man to dissent. This is her hope—that dissenters will speak up. And that is why this letter is written.

There is yet time to save the greatest softwood forest belt in the world—stretching from the Golden Gate through the redwoods, Douglas-firs, hemlocks, and Sitka spruces into southeastern Alaska—if only enough dissenters against present logging "techniques" will speak up, including a few foresters. Do I hear any voices?

ELLERY FOSTER,
Washington, D. C.

[1] The photograph shows the generally accepted method of cutting in the management of mature and overmature age classes of Douglas-fir in the national forests of western Washington. The example on the September 1951 JOURNAL cover shows cutting in the Olympic National Forest; it has, of course, the approval of the U. S. Forest Service.—EDITOR.

The Education and Professionalization of Foresters

Through notable private action two generations ago, and subsequent national and state governmental action and support, schools have been established and maintained to develop foresters for careers in the public service and in private employment. Because of this specialized training with its large technical and operational content, plus the solidarity and sense of responsibility of the foresters, and the public recognition and employment they have won over the years under great leaders, forestry has become a recognized profession. Moreover, the foresters are organized in a nation-wide association, in the Society of American Foresters. Like the doctor in medicine, the lawyer in litigation, and the soldier in war, the forester is looked to increasingly by the public as the authority in his field. While this gives foresters a measure of influence and prestige, it also brings them under a responsible self-discipline, and makes them, like all other professionals, ultimately servants of the public and subject in the last analysis to a vague but none the less real public sanction.

From *American Forest Policy* by
LUTHER H. GULICK, 1951.

Reviews

Principles of Weed Control.

By Gilbert H. Ahlgren, Glenn C. Klingman, and Dale E. Wolf. 368 pp. Illus. John Wiley & Sons, Inc., New York 16, N. Y. 1951. $5.50.

Since this review is written from the standpoint of the forester and range manager only the chapters of interest to these two groups have been considered.

Although written primarily for use in classroom instruction, this book will be useful to foresters, range managers, and research specialists. It presents the complex nature of the weed control problem by combining technical discussions of the various poisons and their effect upon the plants, with easily understood recommendations for specific control measures.

After a brief introductory chapter which covers the history of weed control practices, the following three chapters deal with the principles of weed control, the chemicals used, and the physiological effects of herbicides. Although much of this is technical information of interest mainly to students or research workers, the reader who is looking for practical advice will find it scattered throughout this section.

Control and eradication of weeds by the use of proper crop rotation and various mechanical means as well as the use of chemicals are discussed. Clear and concise instructions for preparing the chemical solutions and determining the amount applied per acre are given together with the necessary warnings about their effects on man and animals and their persistence in the soil. The reported physiological effects on plants are of interest because they explain why the treatments must be applied in the manner and at the time recommended.

Chapter 7 covers the control of weeds in grasslands, a problem often confronting the range manager. The possibility of controlling weeds by proper mowing and/or grazing practices or by the use of fertilizers to increase the vigor of the grass and eliminate the weeds by excessive competition is pointed out. Recommendations for poisoning with 2,4-D are given for use in situations where other methods are unsuccessful or impractical. Range managers will also be interested in Chapter 15 which discusses control measures for some of the more important weeds that are poisonous to livestock.

Chapter 12 deals with brush and undesirable trees. Repeated cutting, burning, digging or grubbing, girdling and poisoning are discussed as control measures. Reports on the most practical types of equipment to use as well as the results obtained are also included. 2,4-D and 2,4,5-T are reported to be the most promising chemicals at the present time although others such as ammonium sulfamate and sodium arsenite have a place under specific conditions. The disappointing feature of this section is the lack of specific recommendations for chemical solution concentrations to use in the application methods discussed. Failing to find it here, readers will have to refer to the publications cited in the bibliography for this information.

The concluding chapter is on application equipment most of which is designed for use in agricultural work. The most useful section for foresters is that on spraying equipment which gives the information necessary for designing spray rigs to apply predetermined amounts of solution.

The illustrations in this book are excellent and numerous and the extensive bibliographies at the end of each chapter will be helpful to the reader interested in delving into details. The appendix contains a list of plants both herbaceous and woody, giving their common and scientific names and their susceptibility to 2-4-D. Author and subject indexes facilitate the location of material in the book.

LOUIS C. MAISENHELDER,
Southern Forest Experiment Station.

Silvicultural Practice, Laboratory Manual.

By Leslie W. Gysel and Earl J. Hodgkins. 44 pp. Michigan State College Press, East Lansing. 1951. $1.75.

This is a well organized teaching guide used in silvicultural methods courses at Michigan State College. It is a field manual, small in size, and contains field tables. The cover and pages are both water resistant.

Thirteen exercises are outlined. The amount of field work time to be devoted to each exercise is given in terms of periods, each period being three hours in length.

The first five periods cover ecological aspects under the headings, community functions of trees in closed stands; a study of openings in forest stands; and growth response of trees.

Three periods devoted to the economic aspects of silviculture include the study of the quality, vigor, and risk of individual forest trees, and the study of the relation of diameter, quality grade, and growth rate in individual trees to actual value increment.

The remaining nine periods are devoted to cutting methods and cover the following: Early changes which follow commercial clear-cuttings in a forest stand, the seed cut in the shelterwood method, cleanings, thinnings, a spacing rule for thinning, timber stand improvement, marking for a selection cutting, and first pruning of a young plantation.

The outline used in the exercises contains a brief statement of purpose; a brief discussion of basic principles related to the problem; a description of the study area indicating the general conditions necessary for the exercise; equipment and organization; a step by step outline of field procedure; and in some exercises a similar outline for office procedure and a suggested summary in which the student states his conclusions or answers pertinent questions.

The authors are to be commended

for emphasizing the ecological and economic principles which underlie good forest practice. However, one danger in a manual of this kind is that the student may learn how to mark a stand to obtain a certain basal area per unit area or how to apply a mechanical spacing rule for thinning without necessarily learning why certain trees should be cut and others left. A teacher who is a good field man can overcome this hazard.

The manual is essentially for hardwoods, although some of the exercises will fit both hardwood and softwood stands. Most of the exercises are broad enough in scope to be of use in a variety of local conditions.

O. D. DILLER,
Ohio Agricultural Experiment Station.

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Irrigation Engineering.

By Ivan E. Houk. 545 pp. Illus. John Wiley and Sons, New York. 1951. Regular ed. $9, College ed. $7.50.

Knowledge of water behavior is becoming a must for foresters and range men. Water is basic to the growth of all plants, and management of forest and range land needs consider water resources and water requirements, to say nothing about water behavior. Until recently, foresters have had to rely upon fragmentary or scattered papers for information regarding some of the simplest facts.

Lately, the situation has been partially remedied as several treatises on hydrology have appeared. The latest of these is volume I of a two-volume work on irrigation engineering by Ivan Houk. This book purports to deal with the agricultural and hydrological phases of the subject. We pass quickly over the agricultural phases because only a few foresters would be interested in much of the content in the last four chapters. The others contain much more pertinent and basic information of interest and value to the managers of our naturally clothed lands.

The author, a consulting engineer, has been more successful than most authors in presenting many of the elementary facts of hydrology in simple terms. Part of the reason for this probably stems from the fact that he has approached his subject more from the standpoint of what the agricultural engineer should know rather than what a hydrological expert, a constructing engineer, or a meteorologist should know. Consequently he has incorporated a lot of material which would not interest the engineer planning big public works, but which undoubtedly will have considerable value to the growing number of engineers who are becoming associated with the new districts our national reclamation policy is sponsoring. And because foresters and range men of the west particularly have a somewhat common interest with the irrigation engineers, this approach meets many needs of both groups.

Mr. Houk is to be commended for the effort he has put into this book. Like other authors of hydrologic texts he has turned primarily to the engineers for help in its preparation. This is not bad in itself, but hydrology is not an engineering subject exclusively. It lies in the field of biology and soils as well. It must deal with growth, transpiration, root development, litter and humus, soil physics and mechanics, soil stability, soil composition and character, and with the interrelations of plants and soils. Until engineers—and others who call themselves hydrologists—really become aware of the limitations of their own profession and call upon others for help in better understanding the forces and processes that produce streamflow and ground water, they will continue to produce incomplete and inadequate works.

It is in the field of soils and plants wherein this book is weak. For example, far too little attention is given the role of plants as moisture depleters. There are two reasons for this, first the subject is not too important to the engineer because he does not understand the life processes involved. Second, there is as yet, relatively little information available. The engineer somehow must come to understand the importance of root depth, the rate and manner plants take water from the soil, and the influence of cover upon soil-water behavior. Especially is this information needed by the engineer hydrologists who are planning various irrigation works. They, as much if not more than the land manager, should have an awareness and deep appreciation of the role of watershed vegetation in the water cycle.

In thus commenting, however, it is necessary to point out that Mr. Houk has provided a rather good discussion of plant-soil-water relations. The text does discuss some things such as infiltration and percolation, field capacity and gravity water, soil moisture, channel and bank storage, and other subjects about which the average forester knows little.

The discussion of snow melt is very good. This subject is so imperfectly understood that the author's explanaton should be most welcome. However, this falls short again because several factors affecting melt—and snow storage too for that matter—are neglected, especially cover conditions.

Evaporation and transpiration are treated as subjects having relatively little in common, and consumptive use a special case rather than a broad interrelated subject. To the reviewer this whole discussion is most weak where it should be strong. This is the place where engineers and plant and soils men should come close together. All too often the professional hydrologist and engineer overlooks the effect of various types of cover on the millions of water-source acres on watersheds directly and vitally affecting irrigation interests.

Erosion and silt are treated in an off-hand fashion. Although there is recognition of both erosion and sediment problems in the book, the treatment accorded them seems strangely out of keeping with their importance in irrigation agriculture. With hundreds of millions of dollars spent or proposed for sediment control in western streams, the subject would seem to require

far more attention in a text.

Having had to work out through study and observation many hydrologic principles, the reviewer can see in this book how the author went through many of the same steps and stages. Because of this, the work should have an appeal to all foresters and range men for they will find that the book leads them easily through the rather tortuous hydrologic path. Unlike other hydrologies prepared by specialists for other specialists, the book is written for a broad audience. Consequently, it omits the great array of mathematical computations and derivations with which engineers and statisticians complicate their writings and by which they try the patience of, if they do not completely exhaust mentally, the reader. It could have been more helpful had it contained a greater number of illustrative charts and diagrams at the expense of the written word.

All in all, this book is one that can be used by foresters to gain a general knowledge of basic hydrology. It is not one that can be recommended for the personal bookshelf of most foresters or land managers though some watershed management specialists may desire it for the extended list of references. Rather it is a book to which foresters should have access through library loans and the like. Further, it is not a text that foresters would use frequently or that one would consult on special problems. Its chief value lies in its easy reading of a technical subject.

E. N. MUNNS,
Concord, Calif.

Indicators of Condition and Trend on High Range-Watersheds of the Intermountain Region.

By Lincoln Ellison, A. R. Croft, and Reed W. Bailey. 66 pp. Illus. Agriculture Handbook No. 19. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 1951. 30 cents.

The expressed purpose of this publication is "to help the range manager judge condition and trend accurately in the course of range inspection." Although of most value to range managers dealing with mountain ranges having high watershed values, it provides an understanding of ecological principles and their relation to multiple land use which should be of benefit to all wild land managers. Since these fundamental principles are so clearly and logically elucidated, the handbook should be included as reference material for college courses in range management, range ecology, and watershed management.

The publication summarizes more than a decade of research by three eminent scientists of the Intermountain Forest and Range Experiment Station, representing the fields of range ecology, forest influences, and geology, respectively. Each of the authors has published material bearing on this topic in previous issues of the JOURNAL. Research Paper No. 6 of the Intermountain Station, *Principles and Indicators for Judging Condition and Trend of High Range-Watersheds*, presented similar material for field trial in 1944. The present handbook is a refinement of this research paper.

There are three major divisions in the subject matter. The first presents a technical foundation of ecological principles underlying the concepts of condition and trend. A range-watershed is characterized as a complex, whole, or system composed of interrelated parts which are normally integrated and adjusted to one another. This concept represents an evolution in ecological thinking from the single-factor cause and effect relationship. Although seemingly more difficult for the range manager to use readily in applying specific remedial management, the concept permits one to detect departures from the normal by a lack of balance in the complex. The influences of animals, climate, soils, vegetation, and topography upon this complex are sketched in some detail. The very important influence of geological formations and parent material on land forms, topography, and soil characteristics of mountain range-watersheds appears to have been overlooked in this section. The often-confusing terminology regarding plant succession and the use of succession in reference to management objectives are clarified and illustrated. These fundamental principles of ecology are treated in an excellent and modern manner.

The second section treats of the fundamentals for judging condition and trend. The pristine or undisturbed range is pictured as a useful reference point, as condition is relative to a particular range's full potentiality in soil stability and in amount and quality of forage. Range classification guides are given in general terms for four situations varying from satisfactory to very unsatisfactory conditions. The unit of classification is the site instead of the type, according to examples given. Trend is classified separately for forage and for soil before a final decision of over-all trend is made. This revision of the senior author's previous standards which invariably linked a downward trend with soil erosion, even when erosion was decelerating and forage was improving, appears more realistic.

More than half of the publication is devoted to the third major division-indicators of condition and trends. Indicators considered are cover, bare soil surface, observed movement of soil, trampling displacement, soil remnants, erosion pavement, lichen lines, active gullies, wind-scoured depressions, aeolian deposits, alluvial deposits, vegetal composition, age classes, annual weeds, invasion of bared surfaces, vegetation in gullies, rill channel ridges, accessibility of palatable species, relics, hedged shrubs, and current utilization.

Almost without exception these indicators are illustrated with photographs or diagrammatic sketches; in some cases the processes which result in these indicators are described in detail. It is also interesting to note that while many have used some of these indicators as applying only to range condition or to trend, most of these are

used directly or indirectly in a dual capacity. Many of these indicators have not been given as specific indicators in previous publications. Notwithstanding this fact, certain rather obvious indicators associated with vigor and litter are not sufficiently stressed, particularly since they rather quickly portray trend which is important in indicating the early changes in range condition.

All in all, this is a high quality publication deserving the attention of educators, research specialists, and administrators fully as much as that of technicians in the field.

C. H. WASSER,
Colorado A & M College.

They Are Your Woods.

By Ross H. Mellinger and Harry Lee Baker. 48 pp. Illus. Conservation Commission of West Virginia, Charleston. 1951. 25 cents.

A new bulletin on the management of farm woodland is not necessarily news but one having "eye appeal," with editorial and typographical layout that will intrigue farmers into reading it is news. *They Are Your Woods*, A Guide to the Care and Improvement of Farm Woodlands of West Virginia, comes as near meeting the requisites for such a publication as any this reviewer has seen.

Authors and editors of farm forestry publications continue to compose and earmark for publication informational material that appears in a pattern now recognized as "least likely to be read by farmers." What is said is important but how it is said is of greater importance. To get farmers to read and after reading, to understand is the basic challenge to editors of this type of publication.

Fifteen years of selling soil conservation and farm forestry to West Virginia farmers acquainted Ross Mellinger with the fact that much of our farm forestry literature is not read. If handouts were to be read, they must be dressed up with pictures and drawings. Texts must be short and to the point. Mellinger has done all this in his bulletin.

From the cover page on, *They Are Your Woods* has reader appeal. Knowing that pictures attract readers, the author has used 72 photos and 25 line drawings, all gathered from many states and agencies. The writing is simple and direct. The bulletin will well serve the farm forestry program of West Virginia. Its layout can serve as a guide for others.

The Conservation Commission is to be commended for its publication of this bulletin. It is to be regretted that it is not on the free mailing list, as a charge limits circulation.

A. C. MCINTYRE.

Flowering Trees of the Caribbean.

Illustrated by Bernard and Harriet Pertchik. 125 pp. Rinehart & Company, Inc., New York. 1951. $10.

In the introduction William C. White explains how this sumptuous volume came into being. The Alcoa Steamship Company with interests in the Caribbean underwrote the cost of the art and the engraving. Essentially, this is a picture book and not a botanical treatise on flowering trees.

In fact, only thirty trees are described and illustrated. But what illustrations! Reproduced in full color, they are approximately 8½ inches square. The brilliance and richness of the paintings are nothing short of superb. Technical accuracy was attained through advice and information provided by professional botanists.

It is interesting to note in passing that several foresters practicing in the tropics aided in selection of the specific flowering trees chosen for portrayal. Apparently, the principal criterion for selection was the spectacular beauty of leaves and blossoms. All the trees are fairly common in the area, and in fact some grow in the southern parts of Florida and California. But in general they are not trees which the average forester is likely to encounter outside the tropics.

Not only are the species themselves strangely beautiful, but their names have an attractive exotic quality that is most appealing. There are, to mention only a few, the red frangipani, the Madre de Cacao, the rose of Venezuela, the flamboyant, yellow poui, and the mountain immortelle.

Although most of the species illustrated do not yield wood of commercial value, a few, such as lignum vitae, are commercially important.

Unfortunately, many foresters lack sufficient income to permit the purchase of expensive books with pretty pictures. And, ordinarily, this reviewer does not recommend technical books unless they have some practical or scientific value to the practicing forester. But this is a case where the price of a book, while high, is worth every cent it costs. Any forest worker who really loves trees for their own sake, and not alone for their utilitarian value, will get his money's worth from the lovely paintings.

Bernard and Harriet Pertchik have finally done for thirty flowering trees of the Caribbean what artists, such as the Audubons and others, have done for the fauna of America. A book with plates produced in six-color process is expensive, and it is doubtful whether the publisher would ever recover the cost if it had been issued as a customary publishing venture. Hence, it is greatly to the credit of the Alcoa Steamship Company that it made this handsome book possible. To Paul Knapp, and to all his associates in the company who helped compile this book, admirers of trees everywhere owe a debt of gratitude.

HENRY CLEPPER.

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Compiled by MARTHA MEELIG, *Librarian, The New York State College of Forestry*

Range Management Section Compiled by FRANCES FLICK, *Library, U. S. Department of Agriculture*

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Society Affairs

Officers and Members of the Council, 1952-1953

GEORGE L. DRAKE, *President*
Simpson Logging Company
Shelton, Wash.

WILLIAM J. BROWN
Woodlands Department
Kimberly-Clark Corporation
Neenah, Wis.

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Southeastern Forest Experiment Station, Federal Building
Asheville, N. C.

C. OTTO LINDH
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University of Washington
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RICHARD E. MCARDLE
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U. S. Department of Agriculture
Washington 25, D. C.

HENRY CLEPPER, *Executive Secretary*
Mills Building, 17th Street at Pennsylvania Avenue, N. W.
Washington 6, D. C.

EARL PORTER
Southern Kraft Division
International Paper Company
Mobile 9, Ala.

PERRY A. THOMPSON
12 Elkin Court
San Rafael, Calif.

RUTHFORD H. WESTVELD
Department of Forestry
University of Missouri
Columbia, Mo.

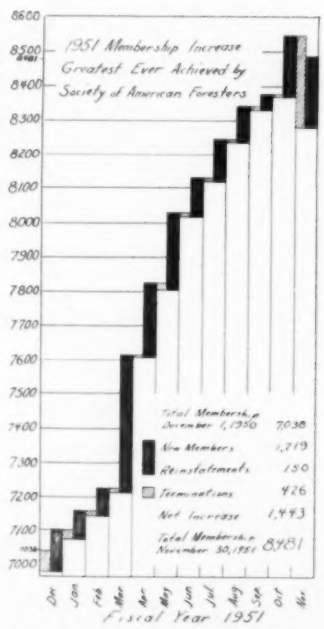
Reports of Officers, Committees, Divisions,
Fifty-First Annual Meeting, Society of American Foresters
Buena Vista Hotel, Biloxi, Miss. December 12-15, 1951

Report of the President
Charles F. Evans

As we come to the conclusion of the 51st year of our life as an organization of professional foresters, it is my function and privilege to report to you on the status of the Society. A more detailed report on finances, membership, and business affairs will be given later by the executive secretary.

Last year I reported to you that our expenditures during the fiscal year resulted in a deficit of $1,458, which was covered by drawing on our reserves. It is a pleasure to report that for the fiscal year ending November 30, 1951, we have a surplus of receipts over expenditures in the amount of $4,676. This was possible only with the most careful management of our finances and business affairs by Executive Secretary Clepper and Business Manager Audrey Warren. Some very important needs, recognized by the Council for several years, have not been met. We should have better office facilities and equipment in the Washington office. The efficiency of the staff and the prestige of the Society would be enhanced by more commodious and attractive working conditions.

The Society is on its way to becoming one of the large professional organizations. The increase in membership from 7,038 on November 30, 1950 to 8,481 on November 30, 1951 is the largest increase on record. Enrollment in the forestry schools and the continuing demand for foresters in the many fields of work justify the belief that a comparable increase in membership can be expected in the next year.



Membership growth in 1951. Chart prepared by Robert D. Hostetter.

My optimism in regard to increase in membership is based on the belief that membership in the Society is becoming increasingly valuable to the individual forester. A much greater degree of professional competence is expected of him in his present day employment than in former years, and he needs the stimulus that comes from interchange of ideas with fellow foresters.

National, Section, and Chapter meetings provide the opportunity and means to supply this need. If the quality of the discussion in meetings may fairly be taken as a criterion of the worth of a profession—and I think it can—the Society of American Foresters has earned a high rank. It seems to me that program committees generally are aware of their responsibility for making the meetings worthwhile to members, many of whom come long distances at personal expense because they hope to get something that will help them in their daily work. Of

course we expect to enjoy the fellowship of colleagues and have some fun but the lighter side of these affairs can easily be found elsewhere and would not maintain our continued interest and support. Officers, national and sectional, must continually strive to offer members something that will help them professionally.

Last year I reported the completion of the reaccrediting of the forestry schools in the United States. The Accrediting Committee did a thorough and competent job and earned the confidence of all concerned. But, as the result of a decision by the Committee and the Council to accredit curricula instead of schools as an entity, some important questions have arisen. They will be discussed by a panel and in open forum later in this session today and I hope that particular part of the program will be well attended. I must resist the temptation at this time to express my own views on the issue that will be discussed but it is entirely proper that I emphasize its significance.

Forestry like all fields of knowledge and practice is becoming more and more specialized. The trend is inevitable and nothing can stop it. In our early and pioneering days the forester with his smattering of silviculture, forest management, range management, utilization, wildlife, engineering, etc. was a jack-of-all trades and, of course, the master of none. His job was mainly custodial. Those days are gone forever. The forestry schools, alert to the needs of the customer, are providing the specialized curricula to meet the demand. But the degree of special training required in all these fields cannot be crowded into a four-year course. No, not even in a 10-year course. Something has to give way.

As Myron Krueger aptly puts it, we are in a transition stage. Eventually most of the specialized fields allied to forestry (i.e., the science, art, or business of growing crops of timber) will become separate professions. In the meantime what concessions should be made? Where should the line be drawn? Did the Accrediting Committee and the Council make a sound decision when they decided that no curriculum would be approved unless it contained a stated minimum training in silviculture, forest management, economics, protection, and utilization?

Basically, it boils down to the question of who is entitled to be called a forester, or, how shall we define the term forestry. It no longer is a question of academic interest only. We are faced with the necessity of making a decision and a most important one. What shall the word "forestry" mean in future years? When a man carries the title "forester" what kind of professional service may landowners and others expect him to give? The Society of American Foresters bears the sole responsibility for the answer to these questions. I have complete faith in the judgment of the members of this organization, provided only that we do not seek a hasty answer. There can be no more productive use of our time in Section and Chapter meetings than in the thoughtful discussion of this problem.

This meeting marks, for me, the conclusion of six years' service as Council member, Vice President, and President of the Society. It has been a most satisfying experience. My own part in the growth and strength of the Society has been small but I am proud to have had an active part in it. It has been a constant pleasure to work with the able and competent staff in our national office and with the men you have elected to the Council. It gives me an abiding faith in the discriminating judgment of our members to know the type of men they have elected to represent them. My faith in the future of our Society and the great profession it represents, is boundless. It will ever be so.

Report of the Executive Secretary

Henry Clepper

I am happy to report that during the 1951 fiscal year the Society operated in the black.

For the first time in our history, the Society's income in 1951 exceeded $100,000. This is still a relatively small amount compared with some of the older and larger professional societies, but it is an indication that the Society has reached another significant milestone in its development.

Recently I made a comparison, which may interest you. In 1937 when I first entered the employ of the Society, our income was approximately $35,000, and we had 4,152 members. Our income in 1951 was $100,078, and we now have 8,500 members.

In 1937 we appropriated to the JOURNAL OF FORESTRY $11,000 exclusive of salaries; for 1952 the cost of the JOURNAL will total about $36,300, exclusive of salaries. In short, the publication of the JOURNAL alone now requires an outlay greater than the expense of running the entire Society fifteen years ago.

I cite these figures, not because I take any satisfaction in increased expenditures, for increased expenditures have no justification whatever unless they result in increased benefits. But it can be shown that the profession of forestry has materially benefitted from the operations of the Society over the years, and that is what counts. Some of these benefits I'll mention later.

In commenting on our financial situation, I want you to know of the continuing efficient management given the business operations of the Society by Miss L. Audrey Warren, our capable business manager. Miss Warren will soon round out twenty-four years of faithful service to the Society and the profession of forestry.

Highlights of 1951

The year 1951 was a notable one because it marked the beginning of the Society's second half century and a period of increased activity by the Society in advancement of the profession. Here are a few, not all, of the highlights.

During 1951 the Council authorized the formation of a new Division of Forest Management, which will hold its first meeting during this convention. The scope of this Division covers not only forest management in its usual sense, but also "the subjects of forest administration (including forest regulation, planning, cutting budgets, and administrative management), protection (including fire, insects, and disease), and mensuration (including growth and yield, inventories, surveys, photogrammetry, and mapping) not otherwise included in other Divisions . . . ."

The Council also authorized two new important committees. The Committee on Safety has been charged with the study of accident prevention in woods operations through improved training. This committee is cooperating with the American Society of Safety Engineers' Committee on Education which is introducing accident prevention into college courses. Seth Jackson of Washington, D. C. is chairman of this Committee on Safety.

Another new committee set up during 1951 is the Committee on Manpower. Its purpose is to develop information on the critical importance of key foresters in fire, insect, and disease programs, and in the production and procurement of forest products. The work of this committee is tied in with the present national emergency.

Dr. Hardy L. Shirley of Syracuse is chairman of this committee.

Substantial progress was made during the year on the Society's forest type bulletin. A new and revised publication, descriptive of the forest types in the United States and Canada, will be issued by the Society in 1952. F. H. Eyre of St. Paul is chairman of this committee.

A committee of the Appalachian Section, under the chairmanship of Prof. W. D. Miller of Raleigh, N. C., completed during 1951 the *Third Cumulated Index* of the JOURNAL OF FORESTRY, covering the 11-year period 1940-1950. This publication is now being printed and will be available for distribution during the spring. The Appalachian Section has the honor of having compiled also the first and second cumulated indexes, covering the JOURNAL since its inception in 1902.

It gives me pleasure to report that the cost of the book *Fifty Years of Forestry in the U.S.A.*, compiled by a committee under the chairmanship of Robert K. Winters, and issued in commemoration of our 50th anniversary last year, will be recovered from sales. The Council had authorized up to $5,000 to underwrite the publication of this book. The book sells for $4. Nearly 1000 copies were sold by the end of the fiscal year 1951. The total cost should be recovered early in 1952. *The Foresters' Manual* is approaching completion. In addition to an editorial committee, there are 19 subject matter committees at work on it. Some committees have already completed their assignments; most should be finished by midyear. Originally expected to contain 500 printed pages, the book will probably have a total of 700 pages. Three commercial publishing houses are interested in its publication, and a contract will be drawn up with one of them for publication late in 1952 or early in 1953.

Journal of Forestry

Albert G. Hall, our editor, has his own report to give and I shall not duplicate it. However, certain aspects of the business side should be mentioned by me.

Gross income from advertising continued to rise. During 1951 gross advertising revenue amounted to $14,000, (net $6,750) as compared with $10,800 (net $4,700) in 1950, and $5,000 in 1949. We expect gross revenue to reach $15,000 in 1952.

It costs money to earn money from advertising, and we are plowing back into promotion and solicitation a substantial part of gross revenue. But it is not impossible that in the foreseeable future, the Society should obtain a net return of $1000 per month from advertising.

Lloyd Thorpe, our advertising representative in Seattle, has done a splendid job and the Council has approved continuation of his work.

In June 1948 the Council "considered the need for a paid editor who would devote full time to the Society's publications, including not only the JOURNAL, but also Forestry News, bulletins and books, the annual proceedings, a biennial directory of members, and other publications as may be authorized by the Council."

"The establishment of a staff office on publications with qualified personnel, as the next major expansion of the budget" was reaffirmed by the Council in June 1949. Again in June 1950 "the Council unanimously went on record to employ a full-time editor at the earliest practicable date, and directed the executive secretary to present to the Council at its December 1951 meeting a list of possible candidates and the budget needed to carry out this proposal in 1952."

There are several members qualified for this position who probably would be interested in it. It is hoped that the amount necessary to establish "a staff office on publications," which would require a full-time secretary as well as an editor, will become available during 1952. The cost of this office is estimated to be $10,000 annually. Meanwhile the Society will continue to employ the services of an editor on a part-time basis, as Mr. Hall has been employed during the past two years.

As mentioned earlier, the budget item for publishing the JOURNAL during 1952 is $36,300, an increase of $3,000 in cost over 1951. This increase, of course, has been caused by higher costs for paper, printing, and mailing rates.

Section Activities

Eighty-one Section meetings were held during the twelve-month period from July 1950 through June 1951.

TABLE 1.—MEMBERSHIP BY GRADES AS OF NOVEMBER 30, 1945-1951

Grade	1945	1946	1947	1948	1949	1950	1951
Student	0	0	0	0	0	0	550
Junior	2151	2648	2954	3058	2909	3315	3861
Member	1891	2037	2304	2699	3205	3195	3467
Fellow	37	43	43	51	48	57	54
Affiliate	125	145	167	186	207	209	269
Associate	135	149	174	186	193	198	206
Corresponding	33	34	38	49	53	52	55
Honorary	10	9	10	12	13	12	13
Total	4382	5065	5690	6241	6628	7038	8475
Increase	40	683	625	551	387	410	1437

TABLE 2.—S.A.F. MEMBERSHIP BY SECTIONS NOVEMBER 30, 1951

Section	Rank	Total	Student	Junior	Member	Fellow	Affiliate	Associate
Allegheny	7	539	40	248	222	4	9	16
Appalachian	5	584	37	288	240	2	12	5
Central Rocky Mountain	14	255	10	93	144	0	5	3
Central States	4	613	99	327	166	2	8	11
Columbia River	2	705	26	360	283	4	19	13
Gulf States	6	552	24	259	210	2	41	16
Inland Empire	19	176	10	87	72	1	3	3
Intermountain	18	180	5	75	100	0	0	0
Kentucky-Tennessee	20	170	5	66	90	0	3	6
New England	8	535	29	206	245	5	30	20
New York	10	384	19	170	175	3	7	10
Northern California	3	675	55	282	281	5	32	20
Northern Rocky Mountain	16	188	3	92	89	1	1	2
Ozark	13	286	32	122	103	1	24	4
Puget Sound	9	420	30	187	178	2	16	7
Southeastern	1	769	79	424	220	2	27	17
Southern California	21	111	7	55	37	2	6	4
Southwestern	17	183	1	90	84	0	5	3
Upper Mississippi Valley	12	326	24	143	138	2	11	8
Washington	15	254	1	53	162	13	0	25
Wisconsin-Upper Michigan	11	344	14	160	149	0	9	12
No Section Affiliation[1]		158	0	74	79	3	1	1
Corresponding Members		55						
Honorary Members		13						
Total membership		8,475	550	3,861	3,467	54	269	206

[1]Includes members in U. S. and foreign countries who have requested that they not be designated as members of any Section.

This represents an increase over previous years, and is an indication of the current heightened interest in the Society. Reports of many of these meetings have been published in Society Affairs, with emphasis being placed on new ideas, projects, or techniques that might be useful to other Sections.

Members of the Council or staff have visited about three-fourths of the 21 Sections during the past year.

Membership

According to R. D. Hostetter, assistant executive secretary, Society membership increased 1,443 from 7,038 on November 30, 1950, to 8,481 on November 30, 1951. This represents an increase of 21 percent.

Membership by grades since 1945 is shown in the accompanying Table 1, and the number of members by grades and Sections in Table 2.

Although the 1951 increase in membership netted 1,443, there were 426 terminations during the same period. Terminations this year represent 5 percent of the total membership.

During 1951, 451 Student Members were advanced to the Junior Member grade. In addition, 607 foresters were elected to the Junior grade without having been Student Members previously, 60 former Junior Members were reinstated, and 8 Affiliate Members were advanced to the Junior Member grade, for a total increase of 1,126.

During 1951, the candidacies of 2,290 persons for admission, advancement, or reinstatment were processed.

Report of the Editor

Albert G. Hall

If the report of the editor of the JOURNAL OF FORESTRY appears, as the record of the year is recited, to be tinged somewhat with an air of self-satisfaction, be it remembered that while a good editor is his own severest critic, he must also be his own best champion. Accordingly, to point first to the accomplishments of the year, the editor and staff wish to emphasize that the 1951 JOURNAL presented to the members of the Society a total of 944 pages, 32 pages more than the 1950 volume.

This was achieved by printing eight JOURNALS of 80 pages each, two of 64 pages, and one, the November or "annual meeting issue," of 96 pages. Despite the use of a greater number of pages, it has not been possible to include in the 1951 JOURNAL all the excellent papers given at the Golden Anniversary Meeting. A number of these are set in type and will still find their way into early 1952 issues of the JOURNAL. In the meantime we will be accumulating from the present 51st annual meeting another backlog of some 75 to 80 papers, many of which will warrant publication. Members of the Society and others have responded well to the urgings of the associate editors for well-prepared articles and as a consequence we now have a more or less steady flow of manuscripts to the editorial office. In order to accommodate these manuscripts and to continue to serve the ever-broadening interests of foresters, the Society may be faced in the not too distant future with the necessity of enlarging the JOURNAL.

Another factor which causes pressure on the pages of the JOURNAL is the growth of the Society membership, and what appears to be a dynamic surge of activity among the Sections and the numerous Society committees and Divisions. This is reflected in the amount of space now found necessary to accommodate the Society Affairs department of the JOURNAL, prepared by Assistant Executive Secretary Robert D. Hostetter. In 1950, this department utilized 103 JOURNAL pages; in 1951 the total was 167 pages. Similarly, the Forestry News department grew from 94 pages in 1950 to 128 pages in 1951, and we are still unable to give prompt and adequate coverage to the many activities affecting the atmosphere in which the profession functions.

Another department which has shown expansion during the year is that of Reviews, in which, largely through the work of Henry Clepper, the coverage rose from 63 reviews in 1950 to 99 in 1951. This department was supplemented again in 1951 by 12 pages of Current Literature, prepared by Miss Martha Meelig of the Library of the New York State College of Forestry and Miss Frances Flick of the Library of the U. S. Department of Agriculture, to give our readers prompt reporting on the many additions to forestry literature.

Expansion is also noted in our Editorials. While the JOURNAL carried only one guest editorial in 1950, it carried six in 1951. In the current year, we carried eight sketches of members in the popular We Present department, compared with six in 1950.

Members of the Society expressed themselves a bit more often in the Points of View department, to which we devoted 24 pages; there were 21

This expansion of the various JOURNAL departments was made at a slight curtailment of the number of full-length papers and a contraction of the Notes department. In the case of the Notes, the number of pages in the department was reduced from 61 to 53, but we were able to offset this by utilizing the shorter notes to fill out pages among the articles. As a consequence, your 1951 JOURNAL was jab-packed, with very little "white-space" occurring in any issue.

Full-length articles in 1951 numbered only 112, compared with 120 in 1950. While the reduction is slight, your editor believes that this should not become a trend; but rather, that more and possibly shorter articles should be included in the JOURNAL, even at the expense of the other departments until such time as the Society can support a bigger JOURNAL. This is said in spite of the expressed belief of many members that we should have greater news coverage, that we should present more of the lighter material—in short, that we should develop more along the lines of a popular forestry magazine. Your editor believes, however, that the JOURNAL OF FORESTRY should assiduously avoid the frills of magazine production in favor of prompt publication of papers of a technical and professional character.

The subject matter of the papers presented in the 1951 JOURNAL is somewhat indicative of the emphases in current forestry practice. Those which fall into the category of silviculture, the basis of forestry, numbered 26. There were 13 articles each in the fields of economics and policy and forest management and engineering. The growing interest in forest soils and influences was expressed in 12 such articles; while forest utilization and range management accounted for 10 articles each. Among the other categories, there were 5 articles on pathology and entomology, 4 on mensuration, and 3 each on forest recreation, forest fire, world forestry, and forest wildlife. Five general articles defied our ability to place them in specific categories; and we had one article in the field of forestry public relations.

This recital of the subject matter of the articles does not mean that some of our associate editors had little to do throughout the year. In many instances, we found it desirable to refer a manuscript to two or more associate editors; this is an indication of the integration of the fields of specialization in the development and practice of on-the-ground forestry.

A report to the editor of the JOURNAL would be grossly remiss in its

recognition of the factors which make the JOURNAL possible, if it did not pay sincere tribute to the volunteer staff of associate editors. These men have given unstintingly of their time to review manuscripts, to seek out writers, to make suggestions to the editor on the handling of material in their respective specialities, and in aiding younger authors in the preparation of their manuscripts. In very few instance has it been necessary to reject a manuscript. However, we have returned many manuscripts to the authors with suggestions, largely those of the associate editors, for improvement. In practically all such cases we have received a note of thanks fro the author and a much improved manuscript in return. This unsung work of the associate editors is one of the major contributions to the profession.

The editor enjoys still another check on his efforts, the efficient and thorough proof reading and secretarial services proved by Miss L. Audrey Warren and the Washington, D. C. staff of the Society.

As your executive secretary has pointed out in his report, the Council has urged the employment of a full-time editor at the earliest practicable date. Following the experience of two years with the JOURNAL in a part-time capacity, your editor agrees heartily with the Council's objective. The Society has grown to the point where volunteer and part-time services are quite inadequate for the job to be done. If the Society through its JOURNAL OF FORESTRY and other publications is to continue to serve the profession in all its aspects and to keep abreast through its publications with the dynamic growth and action in forestry, the time for the establishment of an editorial office is upon us.

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Report of Council Meeting

A meeting of the Council of the Society of American Foresters was held December 12 and 13, 1951, in the Buena Vista Hotel, Biloxi, Miss.

Ten of the 11 Council members were present: President Charles F. Evans, Vice President C. S. Herr, and D. B. Demeritt, S. G. Fontanna, F. H. Kaufert, C. Otto Lindh, G. D. Marckworth, R. E. McArdle, DeWitt Nelson, and Earl Porter; together with Henry Clepper, executive secretary. Fred H. Brundage was unavoidably absent.

In addition to the foregoing individuals, four newly elected Council members were present as observers: President elect George L. Drake, Vice President elect E. L. Demmon, and William J. Brown and R. H. Westveld.

Forestry Terminology

A letter from Ralph C. Hawley was read. It requested permission for Toyo Matsuo, an employee of the Ministry of Agriculture and Forestry at Tokyo, to translate *Forestry Terminology* into the Japanese language. *Forestry Terminology*, a publication of the Society of American Foresters now in its second, revised edition, is fully protected by copyright.

By unanimous vote of the Council, permission was given but with the proviso that the definition of the terms be checked by a qualified Japanese forester acquainted with English. In granting permission for this translation, the Council assumes no sponsorship or approval of the result.

This action was taken on motion of Dean Marckworth, seconded by Mr. Nelson.

Membership Qualifications

A report by the Council Committee on Membership (R. E. McArdle, chairman; D. B. Demeritt and F. H. Kaufert) was presented. On motion of Dr. McArdle, seconded by Mr. Porter, the Council voted unanimously to accept the report and its recommendations.

The report follows immediately after the minutes of the Council meeting.

A resolution from the Puget Sound Section was read and entered in the record of the meeting. The resolution follows:

The profession of forestry, along with other fields of endeavor in the arts and sciences, has in the past 25 years undergone a singular and substantial degree of specialization in its various functions, and while the demands of society have been physically responsible for the need of specialization, a professional group must strike a happy medium in formulating and implementing its elizibility requirements for membership within said group. A careful review of the eligibility standards now prevailing in the Society of American Foresters provides grounds for believing that the S.A.F. is now becoming too exclusively a fraternity of forest managers in the narrow sense of the phrase, and the Puget Sound Section urges the Council of the S.A.F. to open once again for careful review and consideration eligibility standards for S.A.F. entrance requirements as they apply to accredited schools granting professional degrees in forestry, with the avowed purpose of broadening the professional base of the Society to include men whose major fields may be other than strictly forest management.

"Fifty Years of Forestry"

The Council received an accounting from L. A. Warren, business manager, on the book *Fifty Years of Forestry in the U.S.A.*

At its June 1949 meeting the Council authorized that an amount not to exceed $5,000 be expended from the Society's General Investment Fund for the publication of the history of forestry to be issued in connection with the observance of the Society's fiftieth anniversary in 1950. The cost of publication was to be replaced from sales of the book.

The total cost of the project was $4,683, of which the largest item was $4,374 for printing and binding 2,000 copies of the book.

Sales of 940 copies of the book amounting to $3,750 had been realized by the end of the 1951 fiscal year (November 30). The complete cost of the project should be recovered in 1952.

"Foresters' Manual"

The following report was made to the Council by R. D. Forbes, editor of the *Foresters' Manual*, now in process of compilation.

Of the 19 subject-matter committees for the *Manual*, 17 have submitted practically complete manuscripts. One committee's manuscript is perhaps 2/3 in hand, another's is less than 1/3. For the *Manual* as a whole the percentage submitted is estimated in excess of 90.

The editor has reviewed 6 of the completed manuscripts. Five of these he has submitted to members of the Editorial Committee who requested to see them; all of the sections will receive similar scrutiny—a measure of the intense interest which the Editorial Committee is taking in the project.

The material so far submitted has been excellent. Some of it has not been previously published in any form, and much has never been effectively assembled. All of it shows the effect of painstaking thought.

The major problem, as anticipated from the beginning, is condensation. The total of typewritten pages received to date is about 2,050, in sections varying from 23 to 250 pages. The target originally set by the Editorial Committee was a volume of 500 printed pages, or 750 manuscript pages. At its meeting on November 29, 1951 the Committee decided to raise its sights to 700 printed pages. These correspond to 1,050 typed pages, or about ½ the number in hand.

The problem of condensation must be solved in three major ways: elimination of "philosophy" (the *Manual* pre-supposes adequate technical training on the part of its users); editorial reduction, by such devices as a telegraphic style, elimination of the inevitable overlaps between sections, and substitution of diagrams and tables for text; and dropping of some topics of nearly sole interest to specialists. By no means all chairmen of committees honored the editor's request that they indicate priorities for their various topics.

The Editorial Committee will approach prospective publishers early in April.

At its November meeting the Committee decided that the name *Foresters' Manual* is more appropriate than the original *Foresters' Field Manual*. It will be impossible to compress in a pocket manual, for strictly field use, the information we believe foresters will look for in this publication. A single volume of 700 pages can be made to serve effectively men working on a great variety of jobs at points remote from libraries, or from files of the JOURNAL OF FORESTRY, government bulletins, etc. It will be neither a textbook nor a guide to specialists. The immediate demand we hope will come from men now practicing our profession. The continuing sale we anticipate will be among students in their last year or two of school, for use principally after graduation.

R. D. FORBES, *Editor*.

In June 1949 the Council authorized expenditure of an amount not to exceed $6,000 from the General Investment Fund of the Society for the compilation of this manual. Expenditures were to be replaced from sales.

Expenses through November 30, 1951, mostly representing payments

to R. D. Forbes, the editor, totalled $4,454. Inasmuch as the remaining balance of authorized funds will not be sufficient to complete the job, the Council was asked to consider increasing the authorization.

On motion of Dr. McArdle, seconded by Mr. Nelson, the Council voted unanimously to authorize $1,000 in addition to the original amount of $6,000 to complete the *Foresters' Manual*.

The Budget

The budget for the fiscal year December 1, 1951 through November 30, 1952 together with a comparison of income and expense for 1950 and 1951 is shown in Table 1. On motion of Dr. Kaufert, seconded by Mr. Nelson, the budget was unanimously approved as shown.

Certain details in connection with this budget are explained for the information of the membership.

Journal of Forestry

Despite rising paper costs and labor rates, there has not been an increase in the cost of printing the JOURNAL since January 1950. The budget for 1952 contains an increase of 20 percent for printing. This increase, in the opinion of the business office, is reasonable in view of the fact that the lower rates for comparable work cannot be obtained elsewhere.

Office Space

The available office space for the Society's headquarters has been, and remains, inadequate. The Society rents three offices in the Mills Building, each on a different floor. This division of office space does not promote the most efficient or most economical operation, but consolidation of the offices is not possible at present.

With the high rentals and the limited office space available in Washington, there is little that can be done to improve the situation. The budget for 1952 contains a small increase for office rent, which amounts to $3,528 annually.

Salaries

On motion of Dr. McArdle, seconded by Dr. Kaufert, the Council unanimously approved cost-of-living increases in salaries for the staff of the executive office. In all cases, these increases are in line with, but do not exceed, recent salary increases for federal employees, and are based on comparable kinds of work.

The recruitment of competent office help in an area of high government employment is a major problem. The Society's entering salary for clerks and typists is still lower than comparable government grades.

For obvious reasons, the Society cannot meet government salary scales, especially for inexperienced typists and clerical workers, but by raising the entering salary the Society can now attract better qualified personnel.

TABLE 1.—A COMPARISON OF EXPENSE AND INCOME FOR 1950 AND 1951, AND THE BUDGET FOR 1952

Item	1950	1951	Budget 1952
EXPENSE			
Journal of Forestry	$27,507.54	$ 30,893.51	$ 36,300.00
Editor's Expense	111.20	11.52	250.00
Salaries, Executive Secretary and Assistant	12,600.00	13,800.00	14,400.00
Salary, Editor	4,950.00	3,750.00	4,000.00
Salaries, Office	22,290.00	23,646.00	28,090.00
Advertising Retainer and Commission	4,887.49	6,315.38	6,500.00
Advertising Promotion	1,274.63	983.39	1,200.00
Travel, Officers	2,301.04	2,923.58	3,000.00
Postage	1,518.46	1,684.97	1,900.00
Telephone and Telegram	413.40	469.08	600.00
Rent	2,220.74	2,870.00	3,528.00
Multigraph and Mimeograph	310.26	314.00	500.00
Miscellaneous Printing	1,194.75	836.15	1,000.00
Office Supplies	1,143.15	729.80	1,000.00
General Expense	838.15	897.63	850.00
Depreciation	397.72	410.19	500.00
Pension Plan	1,005.65	747.34	696.96
Natural Resources Council	200.00	200.00	100.00
Committee Expense	44.38	61.65	100.00
Grading Forestry Schools	2,262.61	52.96	100.00
Council Travel Expense	1,128.09	1,526.74	1,500.00
Referenda and Election of Officers	870.90	386.70	500.00
Division Expense	13.40	70.78	75.00
American Institute of Biological Sciences	50.00	50.00	50.00
Social Security Tax		491.56	600.00
Miscellaneous	14.40	585.05	25.00
Annual Meeting (Washington)	667.48	232.06	
Section Manual and Student Material	440.74	462.27	300.00
Constitution and Bylaws	537.00		
Membership Directory—Net	2,706.50		
Total	$93,899.79	$ 95,402.11	$107,664.96
INCOME			
Dues	$67,054.34	$ 73,028.81	$ 81,000.00
Fees	4,980.25	3,530.75	3,000.00
Subscriptions and Sale of JOURNALS	7,722.66	7,464.51	7,500.00
Advertising	10,827.56	14,049.28	15,000.00
Interest and Dividends	526.83	496.19	500.00
Miscellaneous Income	1,329.58	1,508.58	750.00
Total	$92,441.22	$100,078.12	$107,750.00
Estimated net earnings	$ 1,458.57 (Deficit)	$ 4,676.01	$ 85.04

Advertising

On motion by Mr. Nelson, seconded by Dean Marckworth, the Council voted unanimously to continue the arrangement with Lloyd Thorpe of Seattle as advertising representative for the JOURNAL OF FORESTRY. Under the arrangement, Mr. Thorpe promotes advertising solicitation through a campaign to acquaint prospective advertisers with the JOURNAL.

Gross advertising revenue has risen steadily since Mr. Thorpe was employed by the Society; it amounted to $14,049 in 1951.

Honorary Member Elected

Dr. William S. Rosecrans of Los Angeles, an Associate Member of the Society, was elected to Honorary Membership.

This action was taken on the nomination of Dr. Rosecrans by the Northern California Section. The Council vote was unanimous on motion by Mr. Herr, seconded by Mr. Fontanna.

According to the Constitution, "Honorary Members shall be (1) persons not foresters who have rendered distinguished service to forestry either in America or abroad, or (2) professional foresters of outstanding achievement whose field of work lies outside of, and who are not citizens of, the United States, its possessions, or Canada."

Among his many contributions to forestry, Dr. Rosecrans is chairman of the California State Board of Forestry, and was formerly president of the American Forestry Association.

Natural Resources Policy

The Society of American Foresters is a member of the Natural Resources Council of America. At a meeting of the Natural Resources Council on October 1, 1951, the membership adopted "A Policy for Renewable Natural Resources." This policy statement had been developed by a special committee of the N.R.C. under the chairmanship of Dr. Ira N. Gabrielson.

The Council of the Society was asked to endorse the statement, at least in principle, in order that the S.A.F. might be listed as a sponsor along with the other national conservation, scientific, and professional bodies which constitute the Natural Resources Council.

On motion by Mr. Porter, seconded by Mr. Fontanna, the Council unanimously took the following action: *The statement "A Policy for Renewable Natural Resources," prepared and then adopted by the Natural Resources Council of America at its 1951 annual meeting, be endorsed in principle but with the understanding that there are general and specific reservations.*

This policy will be presented at the North American Wildlife Conference to be held in Miami, March 17-19, at which time it will be given national distribution and publicity. It will be printed in an early issue of the JOURNAL.

Third Cumulated Index

On motion of Dr. McArdle, seconded by Mr. Demeritt, the Council voted unanimously to thank Prof. W. D. Miller of the forestry faculty at North Carolina State College, and the committee of the Appalachian Section which compiled the *Third Cumulated Index* for the JOURNAL OF FORESTRY.

The index covers the 11-year period 1940-1950, and is now being printed. It should be available for distribution in the spring of 1952.

The first two cumulated indexes were also compiled by committees of the Appalachian Section.

Miscellaneous

The next meeting of the Council will probably be held in the latter part of June, at which time the budget and other matters of Society business will be reviewed.

President Evans thanked the Council members for their service during the past two years, and expressed his personal appreciation for the promptness and care with which they handled Society business matters.

Report of Meetings of Section Delegates

According to the 19 official Section delegates who participated in discussions relating to Section and Chapter functioning in Biloxi, Miss. on December 12, 1951, they gathered many ideas that can be used to advantage in their own localities. Principal subjects of discussion were Section-Chapter relationships and the techniques of planning and conducting good meetings and field trips.

Official Section delegates in attendance were:

Allegheny, Gordon Mark.
Appalachian, Roger W. Wolcott.
Central Rocky Mountain, J. V. K. Wagar.
Central States, Irving I. Dickman.
Columbia River, J. Herbert Stone.
Gulf States, Arthur W. Nelson.
Inland Empire, Knut Lunnum.
Intermountain, not represented.
Kentucky-Tennessee, J. O. Artman.
New England, William C. MacAdam.
New York, R. Milton Hick.
Northern California, Clare Hendee.
Northern Rocky Mountain, Russell LeBarron.
Ozark, Nat Walker.
Puget Sound, Howard Johnson.
Southeastern, J. T. McCullough.
Southern California, not represented.
Southwestern, S. T. Carlson.
Upper Mississippi Valley, Galen W. Pike
Washington, D. C., S. L. Frost.
Wisconsin-Upper Michigan, Maurice W. Day.

Alternate delegates from several Sections also were present.

Assistant Executive Secretary Robert D. Hostetter opened the morning meeting of the delegates by reviewing suggestions for improving Society office services to the Sections which had been received from Section officers during the preceding year. These suggestions included the following:

1. Publish more correspondence from members in Society Affairs.
2. Keep the news of the Society coming to the membership through Society Affairs and communiques.
3. Plan for Society officials to visit more Section and Chapter meetings.
4. Speed up procedure to notify Sections of changes in their rosters of members.
5. Acquaint all new Section officers with the services that are available to them from the Society office.

Problems relating to the administration and financing of Chapters were the principal subject of discussion. J. T. McCullough said that some Florida Chapter members had been considering the advisability of petitioning the Council for recognition of a new Section to be formed from the Florida Chapter. The present heterogeneity of Sections as regards size, form of operation, and extent of interests was noted.

J. O. Artman said that the Society might eventually find it advantageous to form from five to ten "Regions," each with a dozen or so local units. However, he and the other delegates did not believe the present situation was sufficiently critical to recommend any action by the Council now. The consensus of the delegates was that a Section or "Region" should be sufficiently large to provide a diversity of interests among members and sufficiently small to enable members to attend at least one meeting a year. Therefore, they recommended that the Florida Chapter of the Southeastern Section should not be converted into a Section.

The delegates believed that the problem of financing Chapters could best be handled by the Chapters and Sections concerned. The following means are currently used:

1. Kick-back of from 25 to 50 cents of Section dues.
2. Passing the hat.
3. Self-financed activities.
4. Raffles.

The Council met with the Section delegates in the afternoon when a panel led a discussion of "Meeting Mechanics." Council member DeWitt Nelson headed the panel, introducing the following participants and subjects:

S. L. Frost, Washington, D. C. Section—Committee assignments.

Gordon Mark, Allegheny Section—Local arrangements.

John G. Guthrie, Gulf States Section—Publicity.

Maurice W. Day, Wisconsin-Upper Michigan Section—Business sessions.

R. Milton Hick, New York Section—Discussion topics.

Retiring president Charles F. Evans said that he believed the enthusiastic sharing of ideas among Section delegates would result in even better Section and Chapter meetings and field trips.

Report of S.A.F. Council Committee on Membership

The executive secretary will report, as in the past, on the statistical aspects of Society membership. Our report

concerns policy aspects of membership matters.

So far as we know, the Council has before it only one formal proposal on membership requiring consideration. This is the suggestion made a year ago by the membership committee of the Gulf States Section that there be just three grades or classes of Society membership, namely, Member, Fellow, and Associate; and that only graduates of accredited schools be elected to the Member and Fellow grades. Everybody else—those now in the Corresponding, Honorary, Associate, and Affiliate Member grades—would be put in the new Associate grade. There would be no Student Member grade. For 4 years after establishment of this system, the Affiliate grade would be retained—on a temporary basis—to give time for present Affiliate Members to qualify for advancement to the Member grade. During this 4-year period only graduates of unaccredited schools could be elected to this temporary Affiliate grade.

In addition, several informal proposals relating to membership grades and membership requirements have been made during the past year by individual Society members. Although not presented to the Council for action, these should be considered by the Council as a part of its continuing study of this whole subject.

Society members may not often stop to remember how much time and thought the Council and the Society as a whole give to membership policy. In just the past five or six years, for example, there have been several referenda on membership matters, the system of membership grades has been revised, and eligibility requirements have come up for discussion at every Council and many Section meetings. This widespread and lively interest in qualifications for membership is one sign of vigorous health in our Society.

It is important that our members recognize, too, that forestry as a profession is growing fast. Many of our membership problems stem from this rapid growth. Only a relatively few years ago, nearly all forestry graduates had more or less the same kind of basic educational training. Today, the former general courses in wood utilization, range management, and wildlife management have grown into full-fledged, separate curricula. Additional curricula are in process of establishment. At some institutions the forestry school is no longer called by that name but is a department in a school of natural resources. The Society itself has now spread out into 11 different subject Divisions to facilitate and encourage participation by specialists in these subject-matter fields. Petitions to establish additional subject-matter divisions have been circulated. All of this is evidence that, like other professions, ours is beginning to specialize and concentrate in various aspects of what once went by the simple designation of forestry.

Our present system of membership grades is somewhat of a compromise between holding on the one hand to the original concept for membership eligibility and on the other to offering some form of Society membership to those who do not fully meet those basic requirements. Unfortunately, however, this compromise has given us a somewhat unwieldly and frequently confusing system of membership grades. The assistant executive secretary recently prepared an addition to the Section Manual to explain and interpret the requirements for our present system of membership grades. The Council approved this Manual at its June 1951 meeting. We hope this Manual will clear up most of the current difficulties experienced by Section officers in deciding on a candidate's qualifications.

The proposal by the Gulf States Section will require referendum action by the Society as a whole. Although this proposal appears to be simple, it involves some basic considerations on which the Society definitely should not act hastily. Moreover, this proposal should be considered simultaneously with other membership problems now facing the Society. We are not certain that all of these matters properly come within the assigned responsibility of the Council Committee on Membership, but it is probably our job to bring them to the attention of the Council. In our opinion, the present major issues can best be stated as three rather distinct, but related questions:

1. How far does the Society want to go in broadening the present base for immediate acceptance of graduates of accredited forestry schools?

"Broadening the base" can mean either (1) granting voting membership immediately on graduation to graduates of curricula not now approved (range management, utilization, etc.), or (2) providing a nonvoting place in the Society for such graduates by establishing a new Class C Affiliate grade.

At present graduates of nonapproved curricula of accredited schools are not immediately eligible for any grade of Society membership. They are eligible for Associate Membership after three years of acceptable experience in related fields, or for the Affiliate grade after four years of forestry experience. This problem ties back to our comment on the rapid development of specialized curricula in the forestry schools. In 1949, the Society voted to hold to the present professional base for membership.

When forestry schools were accredited in 1950, the application of this base resulted in the acceptance of 41 curricula and the nonacceptance of 34. Since that time, the question of immediate acceptance of graduates of specialized curricula in range management, wildlife management, and most recently in utilization has been raised by many members. The utilization aspect of this subject will be discussed in open forum at the 1951 annual meeting of the Society.

2. Does the Society want to require —without exceptions—a degree in an approved curriculum from an accredited forestry school as an essential to voting membership?

Members are making this proposal with increasing frequency. If adopted, it would leave Associate or Affiliate Membership open to those wtihout professional degrees in forestry but would not permit advancement of these people to the Junior, Member, and Fellow grades. This proposal would establish a hard and fast rule that would be easy to apply. It might not be a popular rule but it would be understandable. But neither ease of application nor ease of understanding should be the basis for making this decision.

Our objective should be establishment of standards of professional competence. Many members believe that the Society and the profession have advanced to the stage where such a requirement is possible and desirable.

3. Does the Society want to telescope the present system of 8 membership grades, some with subclasses, to a smaller number?

Specifically, this proposal would apply chiefly to combination of the Junior and Member grades, and to combination of the Affiliate and Associate grades. It was originally intended that the Junior Grade be a probational grade with advancement to Member grade contingent on proof of full professional qualifications. The idea was good, but as a practical matter it has not worked out well and does not appear to be workable. To many members the only significant difference between the two grades is the amount of dues. Other members say that the elimination of "Senior" from

the Member grade title has destroyed the prestige of that grade. If the present Junior and Member grades are combined, there should be a graduate scale of dues (up to some maximum amount) based on length of service as a Society member.

There is, of course, a real distinction between present requirements for the Affiliate and Associate grades, but members in those grades do not generally understand this distinction or seem to care much about it. Several proposals have been made to combine these two grades also. Other recent proposals would eliminate the Student grade and combine the Honorary and Corresponding grades with the Associate grade.

Recommendations

1. That no action be taken on any of these proposals without further study.

2. That the Council take the necessary steps to get a thorough discussion of these matters in 1952, since it is doubtful if many members fully understand the basic issues involved. The Council should have prepared for distribution to all members the necessary background information. We suggest further that a topic outline be prepared for use by Sections in discussing this subject. This material might well include questions and answers designed to focus attention on key points. In short, we urge that the Council do not leave to chance the important matter of getting this matter thoroughly understood by all Society members.

3. That after thorough discussion by the Society as a whole the Council consider holding a referendum on all or such parts of these proposals as may then seem desirable.

COUNCIL COMMITTEE ON MEMBERSHIP.
DWIGHT B. DEMERITT,
FRANK H. KAUFERT,
RICHARD E. MCARDLE, *Chairman.*

Report of Committee on Safety

After the Council's authorization of June 1951 to organize a Committee on Safety, the following foresters agreed to serve:

E. T. Clark, Pacific Northwest Loggers Association.

Ovid L. Holmes, California Division of Industrial Safety.

Leland W. Hooker, Michigan College of Mining and Technology.

Seth Jackson, U. S. Forest Service.

H. H. Jefferson, American Pulpwood Association.

Charles P. Mead, U. S. Bureau of Animal Industry.

J. Kenneth Pearce, University of Washington.

John Stock, Conifer Lumber Mills.

These men were specially selected for the wide range of their activities and interests. It was felt that a wide background of experience was essential for a group formulating a policy on safety, because this activity affects all forestry workers.

The committee's work will consist of two phases:

1. Preparing a policy statement on safety for the Society. An initial draft has been prepared. This is now being studied by committee members. Their thoughts will be incorporated in the final draft. This will be submitted for Council approval in 1952.

2. Working out the details of putting the safety policy into effect. Nothing concrete has been developed yet, pending completion of the Policy Statement. It is hoped that we will have an action plan ready to present at the 1952 annual meeting.

SETH JACKSON, *Chairman.*

Report of Committee on Community Forests

In its report to the Society in December 1950, your Committee on Community Forests pointed out the urgent need for a national coordinating agency to stimulate action programs for community forests and to act as a clearing house for the collection and distribution of statistics and information. Up to about four years ago, the U. S. Forest Service supplied this service. Then it was discontinued. Since that time your committee has not been able to obtain satisfactory or complete data on the growth of this movement.

Recently your committee wrote to the Forest Service urging that it revive the collection of community forest data. This was followed up with a personal call by the chairman and another member of the committee upon R. E. McArdle. We learned that our request had stirred up considerable discussion and thought as to how the Forest Service, in the absence of an appropriation to finance the work, could enlarge its activities in that field. We were assured that promoting community forests has now been set up as an official activity and that a member of the staff will have this activity included in his work schedule to be handled in connection with his other duties which are financed. That similarly the field officers of the Forest Service at regional and local levels will be charged with responsibility to promote community forests where possible in connection with their regular work. This is fine so far as it goes but, as the Forest Service realizes, it falls far short of what is really necessary to provide leadership in a real action program on a national scale with sufficient follow-up to insure a sustained effort.

The community forest movement suffers from the weakness that local leadership waxes and wanes. Usually the care of a forest depends on the interest and enthusiasm of some individual. When that individual dies or moves away the administration of the forest soon suffers a let-down. Unless there is some sort of a reminder to the responsible authorities that their unit is part of a state and national forestry movement and that they have a responsibility for a sustained program of administration, the forest may fall into disuse or even be abandoned. This has been the history of some once promising forests.

Leadership in this field should primarily be a function of the state conservation department. In a few of the states this leadership has been accepted. Even in those states it is evident that the community forest activity should be definitely assigned to some member of the state forester's staff. This is necessary in order to assure sustained local interest and continuity of program. In a large majority of the states community forests receive no such supervision. National leadership should bring pressure to bear upon the several states to provide this leadership at state levels. Growth of the movement requires the dissemination of information and statistics about community forests. This, also, is a job for national leadership.

Your committee believes that the Society of American Foresters is the appropriate and logical agency to assume general leadership at the national level. It therefore recommends that the Society reaffirm its support of community forests by taking the following definite actions:

1. Urge each Section of the Society to set up a continuing project by appointing responsible and active committees, with a member from each state to promote and assist in the establishment of new community forests in localities where they have contacts and also to bring influence to bear upon the state foresters in their respective areas to exercise their leadership.

2. Use its influence to induce the

U. S. Forest Service and the Association of State Foresters cooperatively to adopt a program for more active leadership in community forests, as is now being carried on in some states. One objective would be to have at least one full-time forester assigned to this work in each state.

3. Since the Society is not in a financial position to assume responsibility for the collection and dissemination of information about community forests, the Council take action to induce the American Forestry Association to take on this function. It ought to be an excellent continuing program for the association in which it would bring forestry forcefully to the people. From the standpoint of the association, this program would seem to be a natural vehicle for bringing to it a popular recognition of its national leadership in forestry promotion. The job would require employment of a forester with an expense account that would permit him to travel over the country, collecting data and first-hand information about existing forests, giving advice on the starting of new forests, preparing publicity material and magazine articles and in other ways promoting the movement.

4. Should the Society not be successful in persuading the American Forestry Association to accept this leadership, we recommend it be proposed to some other organization that has national influence and prestige.

NELSON C. BROWN,
GEORGE A. DUTHIE,
CHARLES G. GELTZ,
E. V. JOTTER,
WILLIAM A. SYLVESTER,
PAUL W. SCHOEN,
HARRIS A. REYNOLDS, *Chairman.*

G. S. McIntire, not being willing fully to approve some of the above recommendations requested that his name not be signed to the report.

Report of Committee on Accrediting

To the Council:

The Committee on Accrediting submitted its recommendations on accredited status for the forestry schools of the United States in December 1950. Since that date we have been engaged in a few items of a confidential nature, already known to you.

In August 1951 the chairman solicited comments from the members of the committee as to possible recommendations for future accrediting committees. These suggestions will be incorporated in a report during the coming year.

It is the hope of the Committee on Accrediting that all members of the Society will give increased attention to the subject of forestry education at this time so that it may reflect the changing needs of the profession.

PAUL M. DUNN,
PAUL A. HERBERT,
WALTER MEYER,
RICHARD J. PRESTON,
MYRON KRUEGER, *Chairman.*

Report of Joint Committee of Society of American Foresters and American Society of Mechanical Engineers

During the year W. D. Hagenstein of the Forest Conservation Committee of the Pacific Northwest Forest Industries at Portland, Ore., became a new member of the committee and should be a most valuable addition. In addition, arrangements were continued for representation of the State Foresters Association on the committee through DeWitt Nelson, retiring president.

Only one meeting was planned for the joint committee in 1951. This was arranged after considerable correspondence for mid-October, at Madison, Wis. Unfortunately, so many late conflicts developed on the part of the busy committee members that it finally became advisable to cancel this meeting. Consequently, committee activities for 1951 did not have the benefit of first-hand discussion and planning of the joint group.

However, correspondence was quite active within the committee and Gilbert Stewart in particular carried out an agreed-on assignment which brings into much better focus one of the important questions of special interest to any joint engineer-forester group, the question of what combined engineering-forestry training should be provided by our universities and how it can be made most effective. Aspects of this study are summarized.

Combined Professional Training in Engineering and Forestry

Gilbert Stewart had already interested himself for some years in the question of how more men qualified to make contributions to equipment development in forestry might be trained, and he was asked in behalf of the committee to investigate the possibilities of increasing the opportunities for joint forestry-mechanical engineering training at several of the universities which have both forestry and engineering curriculums.

He has taken up the question with Yale University, the University of Michigan, the University of Washington, Purdue University, the University of Idaho, and the University of California.

From this correspondence the question has broadened considerably and may well justify attention by the Education Division of the Society and, perhaps, by the Committee on Accrediting.

Reason for Inquiry

The inquiry was prompted by the experience among members of the joint committee with the difficulty of finding equipment engineers who have a concept of forestry problems, and of foresters who understand mechanics. This is one of the basic problems in getting rapid and orderly development of mechanized fire fighting and other forestry equipment. Typically, equipment designed for other conditions and purposes must be adapted to forestry requirements by a slow and painful process rather than by starting with a sound initial design for the purpose intended.

The A.S.M.E. members felt too that mechanical engineering students ought to be made acquainted with career opportunities in forestry and with forest problems.

Need for Men Trained in Both Engineering and Forestry

The types of training for which there is a shortage among recent graduates, as gleaned from various interviews and letters, appeared to be about as follows:

1. Among mechanical engineering graduates too little training in timber mechanics and wood as a raw material compared to metals, plastics, etc. This is felt particularly in selecting recruits for products research, and in recruitment by wood-using industries.

2. Not enough mechanical engineering training among foresters particularly interested in forest products research.

3. Mechanical engineering training among professional foresters now by accident rather than by design.

4. Field of mechanical engineering in forestry commonly not realized among engineers.

5. Civil engineering-forestry training now at some premium in recruiting by forest industries. Often it is important in foreign assignments and

need for more men of such training felt in Forest Service.

6. And more specifically, inadequate professional training in forestry fire control among a majority of forest school graduates and general lack of recognition of engineering aspects of fire job.

How to Provide for Combined Forestry-Engineering Training

This was the immediate subject of Stewart's inquiry in letters to deans of engineering and schools of forestry. It seemed to be the consensus that this is a desirable combination of training but that few students would be willing to undertake the six or seven years now required to obtain a B.S. degree in both engineering and forestry. To shorten the period required for such combined training there was little inclination to revise curriculums for the purpose but a great deal of inteerst at both Purdue and Yale in encouraging combined course work. At Purdue a five-year plan has been studied. At Yale more emphasis is placed on graduate study to prepare for a special field of work. But at present both schools prefer to develop such plans to fit the interested student.

Demand

At Michigan the immediate question was just how many men with particular combinations of such training would be needed annually. Such questions can never be answered positively but the question is very pertinent. Though there seems to be a recognized need and demand for engineering training as an additional qualifying specialty for professional foresters and for some forestry training for a portion of the engineers graduated each year, the very limited canvass by this committee is not adequate to answer the question of how great that demand is, nor how many trained men per year would be needed to satisfy it.

We are transmitting copies of this part of our report to the chairman of the Education Division of the S.A.F. and to the chairman of the Accrediting Committee. We are hopeful that they will give the matter further study and perhaps resolve the question of demand more completely than would be possible by our existing committee. If they agree that the demand is sufficient to justify some further study and plans to meet it, this committee will be happy to cooperate.

The problem of more adequate undegraduate training in fire control is related in part but can be treated as a separate matter.

Spark Arrestor Specifications

The S.A.E. has adopted the standard test code for spark arrestors for internal combustion engines. This goes far toward resolving the dilemma of forest protection agencies which enforce requirements for spark arrestors on automotive and other equipment, but have had no standard of adequacy to back up such requirements. However, the new code requires testing on the engine to which the arrestor is to be attached, and so far the testing agency has not been designated.

The committee will continue its efforts to expedite the final establishment of specifications suited to the needs of forest protection agencies.

General

No new progress was made on several equipment matters that have been carried on the agenda of the committee for some time. One of these is the extension of standardization of the basic unit for slip-on tank trucks. The Forest Service has now evolved specifications that are sufficiently flexible that a number of options in type of pump desired, in capacity of tank and other features can be exercised. If such units can serve a wide variety of requirements among other agencies, quantity production can be undertaken by manufacturers. This can benefit all protection agencies for which such units have a place through better standards and increased economy of purchase. The committee plans further study of this matter.

S. A. F. Committee

HENRY CLEPPER,
CHARLES COWAN,
W. D. HAGENSTEIN,
GILBERT I. STEWART,
A. A. BROWN, *Chairman.*

A. S. M. E. Committee

HORATIO BOND,
J. M. FLOUNDERS,
W. E. MCGRAW,
IRA A. FUNK, *Chairman.*

Report of Committee on Forest Types

A committee has been appointed to revise the bulletin *Forest Cover Types of the Eastern United States.* The most recent edition of this bulletin was issued in 1940 and is now out of print.

A decision has been reached to enlarge the scope of the bulletin and to include eastern Canada. Accordingly, a committee of the Canadian Institute of Forestry with A. S. L. Barnes as chairman has been appointed to work in cooperation on the project.

When the new report is issued for eastern cover types, it is the intention to issue with it under the same cover the descriptions for western types which was originally published as *Forest Cover Types of Western North America.* Dean F. S. Baker was chairman of the committee that prepared this report. The supply of this bulletin is also exhausted.

It is hoped that a revised report including cover type descriptions for both the East and for the West can be completed during the year.

W. A. DAYTON,
DANIEL DENUYL,
R. C. HAWLEY,
P. C. WHEELER,
F. H. EYRE, *Chairman.*

Report of Committee on Scope and Method of Research in the Economics of Forestry

In our December 1950 report to the Division of Economics, your committee stated that we were working against the deadline of June 30, 1951, on the last of our assignments, finishing the manuscript, *Scope and Method of Research in the Economics of Forestry,* and submitting it to the Charles Lathrop Pack Forestry Foundation. The manuscript was submitted in June 1951.

Since June the committee has sent the manuscript to all our advisers, for their final comments. The advisers had previously seen the separate articles that go to make up the book, but this was their first opportunity to read the whole work consecutively. We received a great many helpful suggestions. These will be incorporated into the manuscript at final editing.

The Pack Foundation also has been reviewing the manuscript. On December 4 the executive secretary of the Foundation gave us informal word for use in this report, that the Foudation's review was highly favorable and that they want to publish the manuscript. We have yet to work out the details of format, number of copies, and the like. This will, we hope, be completed within the next couple of weeks. After that there will be a rather large job of editing, on which we expect help

from the Foundation, and a good bit of time will be needed to get final clearance from our contributors. However, if all goes well, the book should be out in 1952.

Throughout the project your committee has been making its financial reports to the Pack Foundation, which supplied the funds for our work. All our detailed records and receipts are in the Foundation's hands. Not as an accounting, therefore, but for your general interest in what it takes to do a job such as this, we would like very much to give you a summary of the project statistics.

During the four years of the project, your committee spent $7,000, which was the amount budgeted in the prospectus and set up by the Foundation. This amount does not include the cost of publishing the book. That will be handled separately by the Foundation.

The first and main item of expense was the hiring of a bibliographer to work on the forest economics bibliography, published last year. This item totaled about $3,000. Our bibliographer put in some 1,800 hours of work, and the Department of Agriculture Library contributed 2,500 hours of the time of one of their experienced technicians, making a total of 4,300 hours, or about 25 working months. The cost of publication was borne by the Library, the U. S. Forest Service, and the Pack Foundation, as we explained in last year's report. The $500 contributed by the Foundation was additional to the $7,000 of regular project funds. All the financing for publishing the bibliography was handled by sponsors directly with the Department of Agriculture Library and not through your committee.

The second major item of expense was $2,020 for secretarial and stenographic assistance. This phase of the project involved, among other things, nearly 4,000 pages of letters to manuscript contributors, project advisers, and others, and 2,500 pages of manuscript in its various drafts. The current draft of the manuscript is about 500 pages. Altogether, your committee received about 2,000 hours, the equivalent of one working year, of secretarial and stenographic help. This does not include contributions made at the offices of contributors and advisers. A good deal of manuscript typing was done there.

The third item was $1,110 for travel. The committee met three times—at Eagle River, Wisconsin, near the start of the project; at Washington, D. C., near the half-way mark; and at Berkeley, California, near the end. In addition, we made several trips to solicit help and to work in person with contributors.

Fourth was $810 for equipment and supplies, of which postage was by far the largest item.

Fifth and last was $60 for telephone calls and telegrams.

We wish that we could give you a good idea of the amount of professional effort that went into the project. We estimate roughly that the committee and our immediate associates devoted an aggregate of three man-years of working time to the job. In addition, our contributors and advisers as a group probably put in close to the same amount. Everyone who helped us gave most willingly of his time, and we would like to express again our gratitude for this fine cooperation.

HENRY J. VAUX,
WILLIAM A. DUERR, *Chairman.*

Report of Committee on Civil Service

After five years of the psychometric type of Civil Service examination, there is still dissatisfaction with results being obtained. Only four schools concede that the present type of examination is reasonably satisfactory, that they could learn to live with it.

A preponderant number of our professional schools urge the return to a subject matter test, if not in place of, at least combined with or supplemented to, an objective test. They fell that while there is correlation between the results of the present examination and performance in school, there are too many exceptions, too many good men who do not qualify, and too many mediocre men who do, that it puts a premium on quick wits rather than on thoroughgoing minds, on good guessers rather than on sound thinkers. The result of such an examination is one factor of evidence to be sure, but in ther opinion it should not be used as an exclusive basis for the selection of a man for a career.

As a result of a conference in Washington on November 26 with officials of the Civil Service Commission (Fordyce Luikart, chief, Examining Division; John Scott and Miss Harrison, representing the Examining Division; H. Dean Cochran and Fred Miller of the Forest Service; Henry Clepper and Victor Beede) we feel that more progress has been made than at any time since the recent war. The consensus of the professional schools was emphasized, was well received, and discussed. We received assurance that a careful study of the possibility of a dual type examination would be made, that representatives of the schools and of the Forest Service would be consulted further, and that the Civil Service Commission could be depended upon to go as far as it could within its limitations, in the direction we favor.

At this date we are not able to quote written assurance of this study, but we expect to receive it and are optimistic enough to believe that further progress will be made.[1]

D. J. WEDDELL,
W. C. PERCIVAL,
E. R. MARTELL,
D. S. JEFFERS,
VICTOR BEEDE, *Chairman.*

[1]A letter confirming the understanding of the Washington Conference follows:

December 18, 1951

Dear Professor Beede:

This letter concerns the conference attended by yourself, members of the Forest Service, and Examining Division staff members on November 26, and your letter related to that meeting. As the discussion brought out, the Civil Service Commission has no fundamental objection to subject matter examinations in forestry or in any of the other areas of professional work. The decision to rely on prequisites of training or experience to insure competence in matters of professional information and to rely on tests of general learning ability to rank competitors on the basis of ability to learn the duties of a position was based on administrative convenience and necessity for economy in the use of available resources. We have studied the effect of this method of selection in all the major professional areas and have found substantial evidence of its ability to predict job success. At the same time, we recognize the possibility of improving the examination by the use of additional tests when circumstances permit.

We have always received full cooperation from the Forest Service in our studies of examination methods. We now have again had assurance of its interest in cooperating fully in the preparation of subject matter questions. (I think you may safely tell the Society of American Foresters that in the foreseeable future a plan for the use of subject matter questions will be developed.)

Toward this objective, we will shortly address an inquiry to our Committee of Expert Examiners in the Department of Agriculture for its advice on the procedure to follow. You will recall that at the meeting Civil Service staff members indicated that our work load would per-

mit the construction of at least one more subject matter examination but that, on the other hand, a complete research study into the ideal content of such an examination and trial of it with the Forest Service to satisfy all concerned that it would be a satisfactory predictor of job success would not be possible this fiscal year.

In the construction of subject matter examinations we take pains to avoid academic questions. We do not want to do over again the work that the universities have done in ranking the competitors in order of their abilities as students and their ability to learn all the proper background material for the practice of their profession. We make every effort to relate our subject matter questions to the job duties required in the employment of the agencies which use the registers. Consequently, while we expect good students to do well on the test and for the most part to succeed on the job, we would not be entirely satisfied about the quality of our test to evaluate it solely against its ability to select outstanding students.

Two courses are open to us. Our choice will be influenced greatly by the advice from our Committee in the Department of Agriculture. One possibility is that we may develop a subject matter test as best we can in cooperation with the Forest Service. We would do this without any extensive study or trial and rely on improving it in future years. This could be done as a consequence of research work which we will undertake as soon as our means permit. The second alternative is to continue the present examining system until the completion of a research study we are now conducting in cooperation with the Soil Conservation Service and the Committee. Usually, we do not make important changes in examination plans until we have validated the proposed new selection devices against the job success of those who do well on them. In this instance we recognize that there is no risk of injuring the quality of the examination by addition of a generally appropriate type of test even though we might not be able to measure the degree of improvement at first. We anticipate therefore that the decision will turn on the work load which our Committee has but that, in any event, the addition of a subject matter test will be included in our plans for the future.

Thank you for the opportunity to confer with you and have the benefit of your advice. We particularly appreciate your recognition of the problems which confront us and the reasonableness of your plea for improvements.

In order that you may have our reply before the meeting of your Society, we are sending a carbon of this letter to Biloxi, Mississippi in care of the Society of American Foresters.

FORDYCE W. LUIKART,
Chief, Examining and Placement Division,
U. S. Civil Service Commission.

Report of Committee on International Relations

Following its 1950 annual report, the Committee on International Relations was instructed to explore the possibilities of the United States acting as host to the Fourth World Forestry Congress, possibly in 1954, and possibly on the West Coast with the Canadian Institute of Forestry as cosponsors. Accordingly, a number of informal contacts was made to determine the attitude of government, industry, and the profession, and to learn the extent of cooperation that might be forthcoming.

For the most part these talks were of an encouraging nature, and plans were laid for a formal survey of possible support. In the meantime, however, the proposal was discussed with a number of European and Asian foresters and these have called attention to the existing currency and cost-of-living situations which quite probably would seriously reduce the participation of foreign foresters. These observers pointed out that, in addition to the initial difficulty of obtaining dollars, the high cost of travel and living in the U.S.A. puts the expense of attending a congress on the West Coast beyond the reach of most European foresters.

While it is true that government men might be able to attend the congress on official funds, this would in large degree negate the major purpose of these congresses, which are designed to provide a forum for foresters in other than government fields—education, industry, etc. While government officials already have access to several organizations for the international exchange of experience—mainly the United Nations Food and Agriculture Organization—the World Forestry Congresses are the only opportunity available to nongovernment men for the exchange of experience and ideas internationally.

Foresters in the American delegation to the annual FAO conference in Rome November 17 to December 7, 1951, have been asked to sound out forestry delegates from other nations on this problem, and it is hoped that this information, not available in time to be included in this report, may be added before the next meeting of the Council. In the meantime, plans to make a more formal survey of cooperation from American agencies are being held in abeyance.

Still another point on which the committee was instructed to act was the question of looking into the organizational framework of the Association Internationale de la Foret et du Bois, with a view to recommending what modifications, if any, are advisable, and what steps necessary in order that it be suitable for either group or individual membership of the Society of American Foresters.

The committee has gone into this question, and inquiries were made in Paris last October regarding the present status of the organization. The Association Internationale is at present in an inactive state, and for the time being at least it seems fruitless to consider either group or individual membership.

No large international meetings of interest to foresters were held in 1951. The committee is keeping itself apprised of the status of a proposed International Congress of Tropical Foresters, to be held under the auspices of the United Nations Food and Agriculture Organization, possibly in 1953. Details and date of this meeting are not yet worked out, but as information becomes available it will be passed on to the membership through the JOURNAL.

The meeting to discuss tropical agriculture and tropical forestry, mentioned in the last report of the committee as having been postponed from the date originally scheduled (1950) was finally held under the auspices of the Food and Agriculture Organization in Ceylon on September 17-29, 1951, but was reduced to a regional meeting concerned with land utilization in tropical areas of Asia and the Far East. The U.S.A. delegation to this meeting included two SAF members: H. B. Donaldson, chief of the Natural Resources Section, SCAP, and Tom Gill, who served as chairman. Present plans are to hold two more regional meetings—one in Africa and the other in Latin America. Dates have not yet been fixed.

During the year the committee has followed its practice of providing letters of introduction and lending printed material to American foresters leaving for foreign assignments. It has also helped plan itineraries for foreign foresters visiting the United States, and has provided them too with letters of introduction. The Society itself, through the Washington Section, was host at a most successful dinner meeting, on October 11th, to thirty-six foreigners who had spent six weeks studying actual fire-fighting techniques in the U.S.

Only one new member was approved for Corresponding Member-

ship during the year. The committee would again like to draw attention to the need for cooperation from the entire membership in suggesting names of foreign foresters who would be qualified for this grade. Material is now being prepared to propose three outstanding foreign foresters and conservationists for Honorary Membership, and when complete these nominations will be submitted to the Council, probably by mid-1952.

Among the year's accessions have been reports of the National Research Council of the Philippines, and Vol. II of the Filipino Forester. Also received in the chairman's office are issues of the *Empire Forestry Review*, *Unasylva*, *Turrialba* (Revista Interamericana de Ciencias Agricolas), and news notes of the Honolulu office of the Pacific Science Council. All these are available for consultation.

The chairman of the committee served throughout the year as the Society's representative on the U.S.-FAO Inter-Agency Committee.

E. C. CRAFTS,
I. T. HAIG,
LEROY HUNTINGTON,
BARRINGTON MOORE,
LYALL E. PETERSON,
J. W. B. SISAM,
J. H. STOECKELER,
TOM GILL, *Chairman.*

Meeting of Division of Silviculture

The meeting was called to order at 9 a.m., December 14, in the Buena Vista Hotel, Biloxi, Miss. by Vice Chairman R. K. LeBarron, acting for Chairman F. S. Baker, who was unable to attend. At various times during the meeting, there were in excess of 250 persons in attendance.

During the morning session four papers were presented. K. B. Pomeroy discussed recent developments in the naval stores industries in his paper entitled "Modern Trends in an Ancient Industry." This was followed by a paper by H. H. Chapman entitled "Result of Thinning in Longleaf and Loblolly Pine at Urania, Louisiana." The paper by R. W. Dingle was entitled "Survival and Growth of Forest Plantations in Missouri." A comprehensive treatment of the entomological problems in southern forests was presented by R. J. Kowal and J. F. Coyne. T. S. Coile failed to appear to present his scheduled paper.

Following the morning session, the problems arising from the 1952 Montreal meeting, in so far as the election of officers was concerned, was described by R. K. LeBarron and R. H. Westveld. It was pointed out that there will be no divisional meetings at the Montreal meeting, but that there will be technical sessions held jointly with the members of the Canadian Institute of Forestry. Co-chairman, one from the United States and one from Canada will be appointed to handle the technical session on silviculture. It was agreed that R. K. LeBarron who becomes chairman as of January 1, 1952 carry over in his position through 1953 when the meeting will be held in the Rocky Mountain area. The position of vice-chairman will be left vacant for the current year, but a new secretary will be elected by letter ballot.

The afternoon session was devoted to a symposium on the silviculture on the southern pine forests. The discussion centered around the relative advantages and disadvantages of even-aged versus uneven-aged forests. Divergent views were presented by the four speakers. After the discussion which followed the four papers, an analysis and summary of the discussion was presented by R. H. Westveld.

A short business meeting followed the presentation of papers in the afternoon at which time Kenneth P. Davis, chairman of the Committee on Forest Practices, made his annual report. The committee recommended that it (1) stimulate and encourage preparation of regional reports on developments affecting forest practices, (2) prepare an annotated bibliography of references appearing in the last few years bearing on forest practices and, (3) if a general appraisal report is prepared that it be short and be confined to major principles. The report was approved and accepted.

As a working member of the committee, Fred Wilson reported briefly on some of his activities in connection with the Committee on Stocking and Stand Density.

A motion was passed that the authors of papers be contacted to determine if they would reproduce enough copies of their papers for the members of the Division of Silviculture.

A nominating committee consisting of Lawson B. Culver, chairman, Sulo Sihvonen, and O. D. Diller was appointed to report back to the secretary a slate of nominations for the office of secretary.

R. H. WESTVELD, *Secretary.*

Meeting of Division of Range Management

The Division of Range Management met on the morning of December 14. Robert S. Campbell acted as chairman of the meeting in the absence of E. P. Cliff. Avon Denham acted as secretary in the absence of Charles Poulton. Approximately 50 people attended the session.

Six papers were delivered by the authors:

"Grazing on Texas National Forests." Paul Y. Vincent, U. S. Forest Service, Lufkin, Texas.

"Managing Beef Cattle on East Texas Timberland." Richard M. Townsend, Southwestern Settlement and Development Corp., Jasper, Texas.

"Highlights of Grazing Research in the East." Weldon O. Shepard, Southeastern Forest Experiment Station, Franklin, Va.

"Forest-Grazing Research in Louisiana." Walter S. Hopkins, Southern Forest Experiment Station, Alexandria, La.

"Getting Better Management on Southern Forest Ranges." Robert E. Williams, Soil Conservation Service, Crowley, La.

"Management and Administration of Range Lands in Japan." Walt L. Dutton, U. S. Forest Service, Washington, D. C.

The new officers for the Range Management Division are as follows:

Chairman, Raymond Price, Southwestern Forest and Range Experiment Station, Tucson, Ariz.

Vice Chairman, M. W. Talbot, California Forest and Range Experiment Station, Berkeley.

Secretary, Grant A. Harris, Utah State College, Logan.

Executive Committee, Odell Julander, Intermountain Forest and Range Experiment Station, Ogden, Utah; Fred Kennedy, U. S. Forest Service, Denver, Colo.; E. H. Steffen, Washington State College, Pullman.

The members expressed their regrets that E. P. Cliff, chairman of the Division, and John T. Cassady, program chairman, were prevented from attending the meeting by circumstances beyond their control. Both Cliff and Cassady were highly commended for the program they had arranged.

Chairman Cliff in a prepared statement which was read at the Division meeting commented in part as follows:

"I recommend that the Division Officers consider inviting members of the American Society of Range Management to attend and participate in our

sessions, and that our members participate in meetings of the Range Society whenever possible. It is also suggested that the Division of Range Management consider the possibilities of having joint meetings with some of the other subject Divisions. For example, when the Society meeting is held in the Rocky Mountain area, it might be appropriate for the Range, Watershed, and Wildlife Management Divisions to have a joint session."

It was the consensus of the group that Mr. Cliff's suggestion be adopted.

AVON DENHAM,
Secretary pro tem.

Meeting of Division of Forest Recreation

The meeting of the Division of Forest Recreation was held in the Fiesta room of the Buena Vista Hotel, Biloxi, Mississippi, on Friday morning, December 14, 1951. Chairman James H. Tyndall presided at the half day session which was attended by some 35 recreation minded foresters.

As a result of a questionnaire previously submitted to 25 foresters in different fields of forestry, the committee had an easy time selecting four timely topics for the session.

Because of the large number of foresters who still have many doubts as to the soundness of the wilderness area policy, it was only natural that a paper giving "An Analysis of the Wilderness and Natural Area Concept" should be presented. J. V. K. Wagar, Colorado A & M College, answered such questions as: How can we invite people into a wilderness area and still maintain it as such? Do we dare publicize these areas for fear of too great a use thus rapidly destroying the areas? If we don't urge people to use these areas, why do we need the 14,000,000 acres which have been set aside? Whom are these areas being maintained for, a choice few, with plenty of time and money to get to these remote areas; or are we really thinking of the greatest good to the greatest number? What happens to a wilderness area when man's activities are completely excluded? In his paper, Mr. Wagar mentioned the need for more "Chambers of Community Betterment" to perhaps replace the dollar minded "Chambers of Commerce." Is this not the "tonic" our nation needs today?

C. Frank Brockman, College of Forestry, University of Washington, presented a paper on "A Practical Approach to Recreation Education." Mr. Brockman reminded the group of the increased importance of recreation on both public and private lands. He told of the move by Weyerhauser Timber Company to control, regulate, and encourage recreation on their timber holdings. He said the basic forestry curriculum as now given is a good foundation for recreation men, but does not include sufficient attention to such matters as relations with the public, including public speaking. He stressed the need for more courses in psychology and sociology in forestry schools. He said training pointed toward the field of forest recreation should (1) provide a broad background in the natural and physical sciences, (2) include basic engineering, (3) give some proficiency in basic skills, such as cost accounting and business law, (4) place a high value upon English—with emphasis upon factual and creative writing—and public speaking, and (5) open the door to an understanding of people through the medium of a basic course in general psychology.

Bernard Frank, U. S. Forest Service, Washington, D. C. presented the paper, "Under What Conditions Can Recreation be Considered the Dominant or Exclusive Use of Forest Land?" Mr. Frank stated that recreation as a full-fledged use can now be said to have attained a mature stature, along with the management of forest lands for timber, water, forage, and wildlife. He noted the ever increasing public demand for more recreational space. Mr. Frank quoted psychiatrists as saying, "No less than one person out of every ten, faces eventual confinement in an asylum or sanitarium," and suggested that the antidote might be to return to the solemity and play afforded by our forested areas. He said many areas, due to their location, scenic attractions, and primitive characteristics, have monetary or social welfare values far exceeding the dollar values which might be gained by exploitation, however well controlled, to warrant their complete dedication to recreational use.

In a paper on "Proper Planning of Campground and Picnic Areas," William N. Parke, U. S. Forest Service, Portland, Oregon reminded the group that camping and picnicking in forested areas, even in less populated states, are two of our most important recreational activities. He stated that the planning of campground and picnic areas on forested lands is a job which should be done by foresters with training and aptitude for this kind of work. Mr. Parke said recreation improvements in forested areas should be aimed at minimizing fire hazards, providing good sanitation facilities, and equipping the area with sufficient improvements to provide for public convenience and enjoyment.

During a short business session the following officers were elected for the next two years: C. Frank Brockman, chairman; Harthon L. Bill, vice chairman, and William N. Parke, secretary.

Meeting of Division of Forest Products

The Division of Forest Products met jointly with the Division of Private Forestry at the Buena Vista Hotel, Biloxi, Miss. on December 14, 1951. The morning session was devoted primarily to forest products with the chairman of the Forest Products Division presiding. The afternoon session was sponsored by the Private Forestry Division. This report covers only the morning session.

Chairman M. M. Lehrbas presided. Total attendance for the morning session was over 200. The program was designed to be of special interest to industrial foresters. The audience participation in discussion following each paper was enthusiastic and interesting. Each speaker had well prepared exhibits to illustrate salient points. Six papers, as listed below, were given.

"Dissolving Pulp from Southern Hardwoods." D. V. Logan, International Paper Company, Natchez, Miss.

"Southern Pine Poles—Problems of Supply and Manufacture." J. A. Vaughn, Southern Wood Preserving Company, Atlanta, Ga.

"From Wood to Wallboard." Arthur M. Nelson, The Flintkote Company, Meridian, Miss.

"The Paper Industry and the Southland Mill." W. C. McHale, Southland Paper Mills, Inc., Lufkin, Texas.

"The Use of Southern Pine in Newsprint." L. L. Bishop, Texas Forestry Association, Lufkin.

"The Conservation of Wood in the Mobilization Program." J. Hugo Kraemer, Lumber and Wood Products Division, National Production Authority, Washington, D. C.

It was voted to continue the present officers: Chairman M. M. Lehrbas, Vice Chairman Fred E. Dickinson, and Secretary R. C. Fraunberger for another year because of the joint meeting the S.A.F. will hold next year at

Montreal, Canada, with the Canadian Institute of Forestry. At that meeting there will be no Division meetings, but there will be a session on wood utilization. Co-chairmen were appointed by the S.A.F. Council for this session. Col. J. H. Jenkins will represent the C.I.F. and R. C. Fraunberger will represent the S.A.F. in arranging a program of primary interest to industrial foresters in both Canada and the U. S. A.

The meeting was adjourned by Chairman Lehrbas at noon to be reconvened at 2 p.m. with the Division of Private Forestry as sponsor.

R. C. FRAUNBERGER,
Secretary.

Meeting of Division of Education

The 1951 meeting of the Division of Education was called to order on the morning of December 12 by Chairman W. C. Percival.

Myron Krueger, chairman, Committee on Accrediting, presented a paper titled "The Society of American Foresters and Forestry Education." He pointed out the direct and indirect ways the Society can help in furthering forestry education. H. H. Chapman acted as discussion leader. The discussion centered around the question of liberalizing Society membership. Mr. Krueger lamented this, pointing out that membership requirements were to be considered by a panel at the Society Affairs Session on Thursday afternoon.

William A. Duerr, U. S. Forest Service, Washington, D.C., read a paper on "Forest Economics as Needed in Course Contents." Mr. Duerr emphasized that forest economics brings together, in proper perspective, all phases of forestry. The discussion leader was E. V. Zumwalt, School of Forestry, Yale University. The need for including economics in all forestry courses was stressed and Zumwalt stated that he could see little need for uniformity in forest economics courses.

The report of the Committee on Graduate Training in Forestry, prepared by Robert Cockrell, was presented by C. F. Korstian. Following the reading of the report the Division passed the following motion: "The Division of Education recommends to the Council that the present Committee on Accrediting be reconstituted as a committee for the Advancement of Forestry Education. This committee shall continue its accrediting functions for undergraduate programs. In addition it should study training at the graduate level and present its findings and recommendations to the Division for consideration. This reconstitution is in recognition of the large contribution the Committee on Accrediting has made toward the advancement of forestry education and its broadening scope."

The morning session ended with the passing of a motion directing the secretary to write a letter to Mrs. J. Lee Deen expressing the Division's sorrow in the loss of the late J. Lee Deen.

The afternoon session opened with Chairman Percival discussing the results of the questionnaire designed to determine the need for a new publication for the more technical forestry articles. After the chairman's discussion, the Division moved to go on record as favoring further exploration of the need for an additional publication for articles unsuited to existing journals.

A very interesting panel discussed the "Place of Adult Education in the Development of Small Forests." The moderator was R. T. Clapp, Department of Forestry, Mississippi State College. Those presenting various aspects of adult education in relation to forestry were J. Walter Myers, Jr., Forest Farmers Association; B. E. Allen, Union Bag and Paper Corporation; H. C. Sanders, Agricultural Extension Service, Louisiana State University; and C. H. Coulter, Florida Forest Service. The discussion leader was C. J. Johnson, Agricultural Extension Service, West Virginia University. As outlined the problem of adult education seemed large enough to require the assistance of all agencies in finding a solution.

The second panel of the afternoon session was concerned with the topic "Producing Better Foresters." Frank H. Kaufert acted as moderator. Presenting the several phases of the panel topic were the following: R. J. Preston, School of Forestry, North Carolina State College; C. M. Kaufman, School of Forestry, University of Florida; P. M. Dunn, School of Forestry, Oregon State College; and R. C. Bryant, School of Forestry & Range Management, Colorado A & M College. The discussion leader was A. E. Patterson, School of Forestry, University of Georgia.

At the close of the session the Division moved to consider the matter of salaries.

New officers of the Division of Education elected to serve during 1952 are:

Chairman, G. B. Hartman, Department of Forestry, Iowa State College.

Vice chairman, K. P. Davis, Department of Forestry, University of Michigan.

Secretary, A. E. Wackerman, School of Forestry, Duke University.

T. D. STEVENS, *Secretary.*

Meeting of Division of Forest-Wildlife Management

Acting Chairman Ernest Swift called the meeting to order on the afternoon of December 14 and appointed Charles H. Stoddard as temporary secretary. All the regular Division officers, Warren W. Chase, chairman, Paul Dalke, vice chairman, and Richard Griffith, secretary, were absent. Because the records of the Division have been lost, the chairman suggested that we keep an adequate record of this meeting.

The first paper, "Present Status and Evaluation of Work Done by the Division of Forest-Wildlife Management," was given by Mr. Swift in the absence of the author. This paper developed a good deal of discussion from the floor.

It was followed by the second paper by Chairman Swift, "Review of Policies and Plans for the Future Work of the Division." It was generally agreed that there was need for obtaining greater recognition of the wildlife management problem by foresters. One means suggested by J. V. K. Wagar of Colorado was the setting up of objectives and principles of wildlife management for each forest type in a manner similar to forest cutting practices. George McIntire of Michigan suggested that a closer working relationship between foresters and wildlife managers be encouraged by public agencies and that public agencies provide technical wildlife advisory assistance to private foresters in developing plans for specific areas.

A third paper, "Progress in the Study of Integrating the Training of Foresters and Wildlife Managers," was read by J. V. K. Wagar in the absence of Harold Steinhoff. In the discussion which followed the suggestion was offered that silvicultural and forest management texts contain chapters on ecology and wildlife management.

The paper, "Progress on the Forest-

Wildlife Management Section of *The Foresters' Manual*," was also read by the chairman in the absence of the author.

Business Meeting

The chairman announced that there would be a meeting of the Division of Forest-Wildlife Management at the North American Wildlife Conference in Miami, March 17, 1952. He appointed Howard Miller of the Fish and Wildlife Service, Atlanta, and Robert Wade, manager of the Wildlife Refuge at St. Marks, Florida, as program co-chairmen for the Florida meeting.

The chairman then asked for suggestions on how the activities of the Division might be improved and strengthened. It was suggested that more articles were needed for the JOURNAL OF FORESTRY on wildlife problems. Frequent mention was made to the need for developing a greater understanding of wildlife management problems by foresters and integrating techniques with regular forestry work. In discussing the possible topics to be included in next year's meeting at Montreal it was suggested that a Canadian speaker be invited to cover the subject of integrated wildlife—forest—watershed—recreation management in Canada. Dr. Wagar suggested that localizing of the discussion subjects for the Division of the annual meetings would create considerable more interest on the part of all of the participants. Another suggestion was offered to invite a speaker from forest industry to discuss wildlife management problems on industrial forest lands.

Following this discussion, the program chairman called for an election of new officers. The following were elected:

Chairman, Ernest Swift; vice-chairman, J. V. K. Wagar; secretary, Galen Pike; and directors, Lloyd Swift and Warren Chase.

CHARLES H. STODDARD,
Secretary pro tem.

Meeting Division of Watershed Management

The second meeting of the Division of Watershed Management was called to order at 2 p.m., December 14, by Vice Chairman E. G. Dunford, acting for Chairman Reed Bailey. In attendance were 50 members and visitors drawn from 17 Sections. Of these, 37 applied for membership during the course of the meeting. This raises the total to 152 members who have signified an interest in water resources and desire to become enrolled as members of the Division.

H. G. Meginnis, in keeping with the theme of the Society meeting on southern forests presented a review of "Watershed Management in the South."

Peter J. Fletcher's paper, "The Hydrologic Function of Forest Soils in Watershed Management," brought out a lively discussion.

"Water Yield Improvement in the United States" was the title of a discussion by E. A. Coleman. He outlined the work of the Conservation Foundation, and a book which he is writing. This book will explain how vegetative management affects water yield control, will summarize the research done in this field, and will appraise the adequacy of our present knowledge.

G. W. Craddock concluded the program with a paper on "Soil Stability Under Use." He disussed some concepts of soil stability objectives and described an approach being followed for determining watershed protection criteria in forest and range lands of the Intermountain Region.

At the beginning of the meeting, Jack Rothacher read the Report of the Objectives Committee. The following statement of objectives for the Division was accepted and approved by unanimous vote:

Objective of Division of Watershed Management

Through committee activities, personal contact and publication within the S.A.F.:

1. To encourage widespread understanding of the fact that water is a major forest land resource, of the significance forest land watersheds as sources of local regional water supplies and, accordingly, of the importance of management of such lands as a factor in the wise use of the nation's water resources.
2. To stimulate appreciation among foresters and land managers of the watershed management problems, such as accelerated erosion and runoff, floods, pollution and stream damage, which may stem from logging and construction practices, overgrazing, mining and other forest land uses conducted without regard for watershed values.
3. To promote the development and application of watershed management policies and techniques as an accepted part of forest land management, particularly those leading to fullest use of timber, range, recreational, and other values compatible with the preservation or restoration of watershed conditions.
4. To further develop the scientific, engineering and economic bases for such policies and techniques through research and through close cooperation with the other professions concerned.

Earl Stone was named chairman of a committee to set up bylaws for the Division and to report at the annual meeting in 1953.

The need for broadening membership aims and objectives of the Society brought on a lively discussion with broad participation by those present. Vice Chairman Dunford appointed a committee of Lewis Turner, dean, School of Forestry at Logan, Utah, as chairman, W. R. Boggess, University of Illinois, Robbs, Ill., and Harold Wilm, U.S. Forest Service, Washington, D. C. This committee was directed to meet with other interested Divisions and individually and jointly to recommend to the president and Council of the Society that membership requirements of the Society of American Foresters be broadened to give full recognition to professional education and experience in watershed management, range management, wildlife management, and related sciences.

W. R. Cummings, chairman of the sub-committee on Forest Influences and Hydrology for the Society's Field Manual, reported that the material assembled by his committee has been submitted to Editor Forbes.

Acting Chairman Dunford announced the next meeting of the Division of Watershed Management will be held in Colorado, 1953.

E. A. JOHNSON, *Secretary pro tem.*

Meeting of Division of Forest Economics and Policy

Chairman Lee M. James presided at the meeting of the Division of Forest Economics on December 14. Attendance totaled approximately 65.

The general theme of the meeting was "Forest Conservation in a Time of National Emergency." Leland Olds, U. S. Department of the Interior, Boston, Mass., serving as keynoter, presented a paper entitled "Conservation in National Policy Today."

Earl W. Tinker, American Paper and Pulp Association, New York, N. Y., represented industrial thinking in his discussion of "Industrial Problems and Points of View.'

Edward C. Crafts, U. S. Forest Service, Washington, D. C., followed with a paper entitled "Government Problems and Points of View."

Having heard representatives of both government and industry, the group then heard the points of view of private individuals and conservation groups as interpreted by Charles Stoddard of Minong, Wis. His paper was entitled "The Point of View of a Consulting Forester."

Following considerable discussion of the papers presented, a business meeting was conducted by a group of about 20 members of the Division.

Chairman James announced that there would be no meeting of the Division of Economics at the 1952 annual Society meeting in Montreal, and in view of this circumstance it might be advisable to elect officers for a two-year term. This suggestion was moved, seconded, and passed. The report of the nominating committee was received and a unanimous ballot was cost, electing the following Division officers for the years 1952 and 1953:

Chairman, Eugene V. Zumwalt, Yale School of Forestry, New Haven, Conn.

Vice chairman, John Zivnuska, School of Forestry, University of California, Berkeley.

Secretary, William A. Duerr, U. S. Forest Service, Washington, D. C.

Executive Committee, George B. Amidon, Minnesota and Ontario Paper Co., International Falls, Minn., and Blair S. Hutchison, Northern Rocky Mountain Forest Experiment Station, Missoula, Mont.

Ralph W. Marquis, reporting for the Committee on Income Taxation in Forestry, stated that an attempt is being made to get certain findings of the committee published in pamphlet form. This booklet will deal with the tax on income from the woodlot of the small forest owner and will likely be published by mid-1952. Marquis moved that the Division of Forest Economics approve the decision of the committee to request the Council to enlarge its responsibility to encompass the relations of all forest taxes to the practice of forestry. The motion was seconded and passed.

William A. Duerr, reporting for the Committee on the Scope and Method of Research in the Economics of Forestry, stated that the report of the committee had been submitted to the Pack Foundation in June 1951. The review has recently been completed and the foundation is planning to publish the report in book form within the next six months. Duerr moved that the chairman of the Division of Economics be empowered, upon completion of the publication of this report, to appoint a Committee on Research in Forest Economics with the objectives of promoting needed research and keeping the Division posted on research being done in the field. The motion was seconded and passed.

Edward C. Crafts moved that the Division recommend to the Council that the name of the Division of Forest Economics be changed to the Division of Forest Economics and Policy. The motion was seconded and passed.

CARL H. STOLTENBERG,
Acting Secretary.

Meetings of Division of Public Relations

An informal get-acquainted meeting of public relations specialists was held on the evening of December 12 in the Buena Vista Hotel, Biloxi, Miss. Chairman James H. Kitchens presided, and John C. Witherspoon acted as secretary in the absence of J. N. Hessel.

This session was devoted to discussion of the functions of the Division, and its possible contributions to the Society and to forestry. Numerous speakers participated, including Albert G. Hall, editor of the JOURNAL OF FORESTRY; S. L. Frost, executive director of the American Forestry Association; and W. R. Hine, chairman of the Committee on Publicity for the 1951 S.A.F. meeting.

Albert Arnst reported that he had represented the Division at a joint meeting of the Council and Division officers held earlier in the evening. In behalf of the Division of Public Relations, he had offered the Council such services as handling local spot news at S.A.F. meetings, sending news items about speakers to their home town newspapers, and writing feature articles about meetings after they have been held.

The regular meeting of the Division was held on the afternoon of December 14, Program Chairman S. L. Frost presiding. Papers were read by the following persons:

"Industry's Stake in Promoting the Public's Knowledge about Forestry" by William C. Hammerle of the Southern Pine Association, New Orleans. This paper was well discussed.

L. L. Bishop of the Texas Forestry Association, Lufkin, presented a paper "Mistakes in Public Education and What They Have Taught Us." This topic was also thoroughly discussed.

The final subject of the session was "Good Examples of State Forestry Periodical House Organs and News Letters," presented by Ralph T. Wall of the Louisiana Forestry Commission at Baton Rouge. His discussion of the topic was illustrated by exhibit material gathered from the states.

The following officers were elected for the two-year period 1952-1953:

Chairman, Albert Arnst, Weyerhaeuser Timber Company, Tacoma 1, Wash.

Vice Chairman, Ralph Unger, College of Forestry, Syracuse 10, N. Y.

Secretary, Charles W. Mattison, U.S. Forest Service, Washington 25, D. C.

A report on the history of the Division of Public Relations has been compiled by a committee of which Floyd Carlson is chairman.

A committee report on the advisability of a national forestry education congress follows:

Advisability of a National Forestry Education Congress

At the Society of American Foresters' 1950 annual meeting in Washington, J. H. Kitchens proposed that the Society sponsor a national educational congress to focus public attention on forestry. More specifically, such a congress was envisioned as an opportunity (1) to define the phases of forestry on which there is general agreement among foresters, (2) to plan for a concerted, cooperative educational program based on these phases, (3) to bring public relations foresters up to date on new developments in their particular field, and (4) to assess present educational efforts and uncover deficiencies. General discussion failed to get any general agreement on the idea, hence this committee report.

The committee is unanimous in believing that the congress as proposed would be untimely. There is much to be done on a regional basis before a national meeting of this kind would be worth while. We do however suggest that the Division of Public Relations make the following proposal to the Council:

1. That the theme for the 1953 annual meeting reflect the informational and educational aspects of forestry;
2. That all Society divisions use that occasion to determine those basic forestry concepts that can be promoted on a national basis; and
3. That each division report its findings to the Council, together with suggestions for getting better public understanding of the concepts involved.

We suggest further that if the Council concurs in the above proposal, the division reports be carefully analyzed and developed into the framework of an active program designed to accomplish the desired results.

C. W. MATTISON,
A. M. SOWDER,
CHAS. A. GILLETT,
ALBERT ARNST,
J. O. ARTMAN, *Chairman.*

Meeting of Division of Forest Management

The newly constituted Division of Forest Management met for the first time at Biloxi, Mississippi on Friday morning, December 14, attended by a gathering which at times exceeded 300 foresters. Chairman S. H. Spurr explained that the Division was intended to include the broad fields of forest administration, forest protection, and forest mensuration. Subdivisions of these fields, such as administrative management, fire control, insect and disease control, aerial photogrammetry and photo interpretation, growth and yield predictions, forest regulation and allocation of cut were all recognized as coming within the scope of Division activities. The 1951 program was designed to strike a balance between the various elements comprising the Division, in the hope that splintering into numerous small, narrow, highly specialized groups could be avoided.

Chairman Spurr explained that the S.A.F. would meet jointly with the Canadian Institute of Forestry in Montreal in 1952, and that special technical sessions would be held which would not exactly correspond with present S.A.F. Divisions. Special co-chairman for these technical sessions would be chosen by the Council. For this reason, Divisional Officers elected in 1951 would be asked to serve at the 1953 national S.A.F. meeting, rather than in 1952. A nominating committee, consisting of Theodore Krueger, chairman, Walter H. Meyer, and Don Young, was then appointed. After the necessary preliminaries had been disposed of, the following papers were presented, followed by questions and discussion from the floor in most cases:

1. "Developments and Progress in Attacks on Southern Fire Protection Problems." A. W. Hartman, U. S. Forest Service, Atlanta, Ga.

2. "Organization and Handling of Prescribed Burning." John W. Squires, Mississippi Products, Inc., Jackson, Miss.

3. "Aerial Photographs, a Practical Tool in Forestry." T. E. Bercaw, Gaylord Container Corp., Bogalusa, La.

4. "Interrelations Between Military and Forest Photo-Interpretation." Robert N. Colwell, U. S. Naval Photo Interpretation Center, Washington, D. C.

5. "Use of Aircraft in Disease Scouting." Marvin E. Fowler, Division of Forest Pathology, Bureau of Plant Industry, Soils, and Agricultural Engineering, Beltsville, Md.

When the Division reconvened in the afternoon, Chairman Spurr turned the meeting over to Vice Chairman Don Young. The report of the nominating committee was received and accepted by unanimous vote. The officers elected for the next regular meeting in 1953 were as follows:

Chairman, DeWitt Nelson, Sacramento, Calif.

Vice Chairman, Gordon D. Fox, Chevy Chase, Md.

Secretary, Stephen H. Spurr, St. Paul, Minn.

The technical session then continued. Unfortunately, W. K. Beichler was unable to deliver his scheduled paper, but otherwise the program went on as planned, with the presentation of the following papers:

6. "Profit Possibilities From Intensive Management of Loblolly Pine." R. R. Reynolds, U. S. Forest Service, Crossett, Ark.

7. "The Periodic Inventory in Forest Management—a Specific Example." Walter H. Meyer, School of Forestry, Yale University, New Haven, Conn.

8. "Present Status of Management Plans in the National Forests." L. S. Gross, U. S. Forest Service, Washington, D. C. (read by Stanley R. Johnson, U. S. Forest Service, Double Springs, Ala.).

9. "Progressive Forest Management in California." DeWitt Nelson, State Forester, Sacramento, Calif.

Limitations of time occasionally cut short discussions, but interested individuals usually pursued the authors after the regular meeting and settled their questions man-to-man. On the whole, it appeared that the new Division will interest a considerable group.

LEWIS R. GROSENBAUGH, *Secretary.*

Candidates for Membership

Candidates for admission (except those for Student Member grade), advancement, or reinstatement whose membership applications were received in the Society office during the month of December 1951 are listed below.

Action regarding the eligibility of these candidates will be taken by the Council as of March 1, 1952. Any communications from voting members relating to the membership eligibility of any of these candidates should be received in the Society office prior to that date.

The names of these candidates who become members of the grades for which they have applied will be published in subsequent issues of the JOURNAL OF FORESTRY.

Allegheny Section

Junior Grade

Waddell, H. T., Box 223, Pleasantville, Pa.; Pa. State, B.S.F., 1951.

Member Grade

Zimmerman, J. B., Consultant Forester, Stoystown, Pa.; Pa. State, B.S.F., 1936. (Junior, 36R50).

Appalachian Section

Junior Grade

Gaby, L. I., Grad. Student, Duke Univ., Durham, N. C.; Univ. of Fla., B.S.F., 1951.

Central Rocky Mountain Section

Junior Grade

Fiebelkorn, C., Forester, U.S.F.S., Custer, S. Dak.; Mont. State, B.S.F., 1941; Univ. of Calif., M.F., 1950.

Member Grade

McKennan, R. B., Forest Supv., U.S.F.S., Colorado Spring, Colo.; Iowa State, B.S.F., 1926. Reinstatement.

Central States Section

Junior Grade

Miller, L. W., 710 E. Grand River, Howell, Mich.; Purdue Univ., B.S.F., 1951. (Student, 1951).

Stewig, C. E., Lacquer Lab. Trainer, American-Marietta Co., Kankakee, Ill.; Univ. of Mich., B.S.F., 1951.

Tucker, T. R., Land Appraiser, Dept. of Cons., Roscommon, Mich.; Mich. State, B.S.F., 1941.

Columbia River Section

Junior Grade

Calder, D. G., 1828 Hilyard, Eugene, Oreg.; Oregon State, B.S.F., 1951.

Member Grade

Thomson, W. G., Forester, U.S.F.S., Portland, Oreg.; Univ. of Wash., B.S.F., 1931; M.F., 1933. (Junior, 35R52).

Gulf States Section

Junior Grade

Abbott, W. H., Proj. Forester, U.S.F.S., Holly Springs, Miss.; Oregon State, B.S.F., 1948.

Davis, M. M., Forester, Masonite Corp., Laurel, Miss.; La. State Univ., B.S.F., 1951.

Evans, J. E., Jr., Asst. Cons. Forester, Lemieux Bros., Inc., New Orleans, La.; La. State Univ., B.S.F., 1950.

Weaver, H. E., Asst. Forestry Educator, Texas Forest Service, College Sta., Texas; Purdue Univ., B.S.F., 1947; Cornell Univ., M.S. Ed., 1948.

Affiliate Grade

Edens, R. F., Forester, Edens-Birch Lbr. Co., Corrigan, Texas; Stephen F. Austin State College, B.F., (Forestry), 1950.

Erambert, G. F., Nurseryman, U.S.F.S., Brooklyn, Miss.; Pa. State, Forestry (4 yrs.). Reinstatement.

Kentucky-Tennessee Section

Junior Grade

Matthews, H. W., Jr., 506 N. Wilson Blvd., Nashville, Tenn.; Univ. of Ga., B.S.F., 1951. (Student, 1951).

New England Section

Junior Grade

Goodhue, S., Dist. Chief, New Hamshire Forestry Div., Lincoln, N. H.; Mich. State, B.S.F., 1933. (Reinstatement).

New York Section

Junior Grade

Tierson, W. C., Forest General Foreman, Huntington Wildlife Forest, Newcomb, N. Y.; State Univ. of N. Y., B.S.F., 1949.

Northern California Section

Junior Grade

Greig, J. E., Forestry Trainee, State Div. of Forestry, Monterey, Calif.; Univ. of Calif., B.S.F., 1950.

Walker, C. M., Editor, U.S.F.S., Berkeley, Calif.; Oregon State, B.S.F., 1950.

Weaver, R. W., Forest Firefighter Foreman, State of Calif., Monterey, Calif.; Univ. of Calif., B.S.F., 1950.

Northern Rocky Mountain Section

Member Grade

Neils, G. F., Mgr., Logging Dept., J. Neils Lbr. Co., Libby, Mont.; Univ. of Minn., (Junior, 1944).

Ozark Section

Affiliate Grade

Cunningham, C. F., Block Forester, Dierks Lbr. and Coal Co., Broken Bow, Okla.; Ark. A & M., B.S.F., 1951.

Henricks, B. D., Forest Tech., Int. Paper Co., Sheridan, Ark.; Okla. A & M., B.A., 1951.

Hood, W. L., Forest Tech., Int. Paper Co., Camden, Ark.; La. Poly Inst., B.S., (Forestry), 1950.

Lord, J. S., Jr., Dist. Forester, Dierks Lbr. and Coal Co., Umpire, Ark.; La. Poly. Inst., B.S., (Forestry), 1950.

Swilley, J. W., Jr., 815 W. Faulkner, El Dorado, Ark.; Univ. of Ga., B.S.F., 1951. (Student, 1951).

Puget Sound Section

Affiliate Grade

Gerdes, B. C., Forester, St. Paul & Tacoma Lbr. Co., Tacoma, Wash.

MacDonald, J. L., Dist. Forest Warden, State Div. of Forestry, Beaver, Wash.

Metke, L. R., Dist. Land Agent, Weyerhaeuser Thr. Co., Longview, Wash.; Macalester College, (3 yrs.).

Southeastern Section

Junior Grade

Gilmer, W. D., Woodyard Engr., Brunswick Pulp and Paper Co., Brunswick, Ga.; Duke Univ., M.F., 1951.

Green, J. S., Lenox, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).

Griffin, H. J., Univ. of Ga., Athens, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).

Harper, R. W., 185 Fortson Drive, Athens, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).

Forestry Employment

S.A.F. members wishing the Journal's assistance in securing forestry employment are privileged to insert from one to three, consecutive, 60-word advertisements in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously, the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiation.

Positions Available

Recent forestry graduate for assistant forester's job in timber management. Prefer man with family. Location Southeast Oklahoma.

Details on request. Box S, Journal of Forestry, Mills Building, Washington 6, D. C.

Wanted technical foresters between the ages of 21 and 32 to fill positions as county foresters in a southern state. Duties include fire control, management, reforestation, and public relations. Excellent advancement opportunities in an expanding organization. Immediate placement.

Box L, Journal of Forestry, Mills Building, Washington 6, D. C.

Graduate forester with experience in cruising hardwoods along the Gulf Coast. Excellent future for right man. Write giving detailed information and references; also salary expected.

Box 765, Albany, Georgia.

Wanted experienced forester to fill the position of Woodland Forester at Sandpoint, Idaho. Man must be capable of cruising and developing management plans and must have ability to sell himself and sound, economical forestry to small private woodland owners. Further information supplied upon request. Write, giving detailed information and references. Immediate placement possible.

State of Idaho Forestry Department, State House, Boise, Idaho.

Wanted hardwood lumber grader and hardwood lumber salesman for a well-established firm in northern Ohio. If you are interested, write

Ohio Forestry Association, Southern Hotel, Columbus, Ohio

Wanted several young technical foresters with experience in marking and cruising timber; also compassmen to work with experienced cruisers. Work located mainly in Southeast, with established consulting forester.

Box C, Journal of Forestry, Mills Building, Washington 6, D. C.

Opportunity for several young foresters to obtain experience in logging and silvicultural work on intensive forestry operations in central New England. Chance for right party to start own business.

Fred M. Hunt, West Rindge, N. H.

Positions Wanted

Graduate forester, 29, M.F., Yale 1949, now employed by a State Forestry agency, desires position with better opportunity in a progressive forest-owning or wood-utilizing firm in Northeast. Experience has included work on forest inventories, timber management, and public contact. Background in sciences, economics. Veteran; married, one child. References and details upon request.

Box A, Journal of Forestry, Mills Building, Washington 6, D. C.

Forestry graduate, B.S.F., 27 years old, married, no children, desires position, preferably in park work, research, city park or forestry department. Experience with U.S.N.P.S. and U.S.F.S. Several U.S. Civil Service grades. Member S.A.F. Excellent for public contact. References and detailed information on request.

Box O, Journal of Forestry, Mills Building, Washington 6, D. C.

Hill, H. L., Box 172, DeFuniak Springs, Fla.; Univ. of Fla., B.S.F., 1950.

Jackson, N. R., Milledgeville, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).

Lancaster, J. K., Jefferson Rd., Athens, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).

Prouty, L. E., Jr., 607 Euclid Ave., Mobile, Ala.; A.P.I., B.S.F., 1951. (Student, 1951).

Smith, A. C., Univ. of Ga., Athens, Ga.; Univ. of Ga., B.S.F., 1951 (Student, 1951).

Tiller, E. J., 207 Hunt St., Milton, Fla.; Univ. of Fla., B.S.F., 1949.

Utsey, A. L., Univ. of Ga., Athens, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).

Weber, R. L., Box 823, Jacksonville Beach, Fla.; Univ. of Fla., B.S.F., 1951.

Wooten, R. F., Univ. of Ga., Athens, Ga.; Univ. of Ga., B.S.F., 1951. (Student, 1951).

Southern California Section

Honorary Member

Rosecrans, W. S., Chairman, Calif. State Board of Forestry, 1151 South Broadway, Los Angeles, Calif.; A.B., 1908; A.M., 1911; LL.D., 1948. (Associate, 1943).

Wisconsin-Upper Michigan Section

Associate Grade

Scott, W. E., Adm. Asst. to Director, Wis. Cons. Dept., Madison, Wis.; Kalamazoo College, B.A., 1933.

New Members and Advancements

Individuals who became members of the grades indicated during the month of December are listed below.

Allegheny Section

Student Grade

PENNSYLVANIA STATE COLLEGE

Johns, R. P.

Junior Grade

Kirch, J. H., Clearview Rd., Glenshaw, Pa.

Lewis, G. H., 832 N. 5th St., Reading, Pa.

Taylor, L. S., Jr., 733 W. College Ave., State College, Pa.

Forestry graduate, B.S.F., in general forestry, M.F. with major in wood utilization, 4 years experience administering timberlands. World War II veteran, age 33, married with two children. Desire position in research in wood utilization but qualified for work in timberland management. References and detailed information upon request.

Box R, Journal of Forestry, Mills Building, Washington 6, D. C.

Graduate forester, 38 now employed in private industry; a logging and woods products operation. Six years with present concern. Desire to relocate for better opportunity. Prefer private industry. Experience includes logging, aerial photographic mapping, administration of logging contracts, reforestation, stand improvement work, growth studies, surveying, personnel labor relations, timber appraisal, insect, disease and fire control work. References and details upon request.

Box M, Journal of Forestry, Mills Building, Washington 6, D. C.

Forester, B.S.F. and M.F.; 27, married, 2 children; experience in sawmills, woodland management, job supervision, and pulpwood procurement; desires job in management or utilization in the Northeast. S.A.F. Junior Member.

References and detailed information on request. Allen W. Neff, Reeds Ferry, N. H.

Graduate forester, 26, married, veteran, desires permanent forestry position. Diversified experience in wood procurement and management fields. Junior member of S. A. F. References and details on request.

Box T, Journal of Forestry, Mills Building, Washington 6, D. C.

Appalachian Section

Fellow Grade

Damtoft, W. J., Champion Paper and Fibre Co., Canton, N. C.

Demmon, E. L., Southeastern Forest and Range Exp. Sta., Asheville, N. C.

Central Rocky Mountain Section

Associate Grade

Berner, L. M., 216 Main St., Rapid City, S. D.

Central States Section

Student Grade

MICHIGAN STATE COLLEGE

Schoener, R. J.

Junior Grade

Cochran, W. M., 415 S. Ninth St., Lafayette, Ind.

Jones, R. A., R.R. #4, Circleville, Ohio.

Richardson, J. M., Jr., c/o General Delivery, McArthur, Ohio.

Gulf States Section

Junior Grade

Peters, L. C., 1406 Letitia St., Baton Rouge, La.

Inland Empire Section

Junior Grade

Muehlethaler, C. J., R.R. #2, Rathdrum, Idaho.

New England Section

Junior Grade

Sawyer, R. L., 419 Summer St., Auburn, Me.

New York Section

Fellow Grade

Guise, C. H., Dept. of Cons., Cornell Univ. Ithaca, N. Y.

Shirley, H. L., College of Forestry, State Univ. of New York, Syracuse, N. Y.

Junior Grade

Capone, P. C., 227 Delaware St., Syracuse, N. Y.

Northern California Section

Student Grade

UNIVERSITY OF CALIFORNIA

D'Amelio, J. F. Kirkendall, P. G.
Fish, H. S.

Fellow Grade

Fritz, E., School of Forestry, Univ. of Calif., Berkeley, Calif.

Krueger, M. E., School of Forestry, Univ. of Calif., Berkeley, Calif.

Puget Sound Section

Fellow Grade

Heintzleman, B. F., U.S.F.S., Juneau, Alaska.

Southeastern Section

Student Grade

UNIVERSITY OF FLORIDA

Baker, W. L. Hill, H. J.
Childs, W. L. Lawyer, R. O.
Drake, D. T. Patterson, E.
Flottman, A. H. Read, R. E., Jr.
Gandy, J. D. Schroter, D. A.

Junior Grade

Hyatt, A. J., Elks Bldg., Huntsville, Ala.

Southwestern Section

Junior Grade

Arnold, H. G., Box 1762, Casa Grande, Ariz.

Upper Mississippi Valley Section

Student Grade

IOWA STATE COLLEGE

Schutt, W. W.

Washington Section

Fellow Grade

Morrell, F. W., 707 Beverly Drive, Alexandria, Va.

20 Million
TREES a year!

Yes, every year we start at least that many more trees on the way to hardy, successful tree-hood: Seedlings for Forest and Christmas Tree plantings; Transplants for Conservationists, Timber-operators, Farmers and other owners of idle land.

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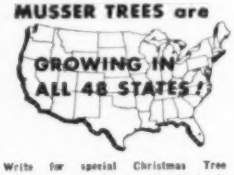

Write for special Christmas Tree Growers' Guide, and complete Wholesale Planting Stock List; or tell us your requirements.

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Save **3 WAYS WITH**

BRIGHT SPOT
TREE MARKING PAINT

Blue—White—Yellow—Red—Orange

- Double Strength — user can dilute with equal amount of kerosene to make spray consistency for pine.
- Saves Time—mixes easily and quickly; does not clog the gun.
- Low Cost — per gallon prices are:

In 5 gallon Pails, 50 gallons and more	$1.50
In 5 gallon Pails, less than 50 gallons	1.60
In 1 gallon cans, 4 to case, 52 gallons and more	1.60
In 1 gallon cans, 4 to case, less than 52 gallons	1.70

We pay freight up to ten cents per gallon on orders of 20 gallons and more.

JIM CRAIG SUPPLY SERVICE

Leavell Woods Station

Jackson, Mississippi

Associate Grade

Williams, E. T., Div. of Forest Economics, South Agric. Bldg., Washington, D. C.

Wisconsin-Upper Michigan Section

Fellow Grade

Hunt, G. M., Forest Products Lab., Madison, Wisconsin.
Price, J. H., U.S.F.S., Milwaukee, Wisconsin.

Foreign

Fellow Grade

Curran, H., Forestry Div., Ministry of Agric., Caracas, Venezuela.

Member Grade

Turner, M. R., Universidad Los Andes, Escuela Forestal, Merida, Estado Merida, Venezuela.

Names Dropped From Membership Roll

Below are the names of all persons whose membership in the Society terminated from January 1, through November 30, 1951.

Deceased

Fellow Grade

Graves, Henry S., New Haven, Conn.
Peavy, Dr. G. W., Corvallis, Ore.
Peck, Allen S., Denver, Colo.

Member Grade

Andrews, Horace J., Portland, Ore.
Brown, Harry P., Syracuse, N. Y.
Bryant, E. S., Bolton, Vt.
Deen, J. L., Fort Collins, Colo.
Forward, Charles H., Juneau, Alaska
Hastings, Alfred B., Mansfield Center, Conn.
Headley, Roy, Washington, D. C.
Heller, Charles J., Port Arthur, Texas
Joy, Edward L., Belmont, Mass.
Morbeck, George C., Altadena, Calif.
Olson, Clarence P., Roswell, New Mex.
Park, Robert H., Price, Utah
Ramsdell, Willett F., Ann Arbor, Mich.
Skuce, Thomas W., Washington, D. C.
Sloss, Ralph W., Milwaukee, Wis.

Junior Grade

Beisel, Darryl V., Lehighton, Pa.
Berquist, Donald G., Denver, Colo.
Berry, James B., Winter Haven, Fla.
Fisher, David D., Coos Bay, Ore.

Affiliate Grade

Bennett, Thomas M., Fairbanks, Alaska
Sperling, Harry, Juneau, Alaska

Associate Grade

Council, K. Clyde, Wannish, N. C.
Jones, Ted T., Minneapolis, Minn.
Ryan, Walter J., Tacoma, Wash.

Resigned in Good Standing

Member Grade

Augustine, William B., Lakeview, Ore.
Blue, Ernest W., Poland, N. Y.
Burma, George D., Stewart, Nev.
Burwood, G., Kenneth, Oakdale, Conn.
Centerwall, Bruce, Hot Springs, S. D.
Clark, Kenneth W., Molalla, Ore.
Coover, Chester A., Lancaster, Calif.
Erickson, Herbert J., Coeur d'Alene, Idaho
Gundersen, Arden B., Salt Lake City, Utah
Gustafson, R. O., Morgantown, W. Va.
Lessel, Leonard R., Williams, Ariz.
Linthacum, Victor T., Missoula, Mont.
Moyer, J. F., Des Moines, Iowa
Murphey, Frank T., Garland, Pa.
Nicholson, R. L., Melbourne, Fla.
Nickless, Lester, Chicago, Ill.
Pitt, Evan N., Dickson, Tenn.
Poley, William F., Monte Vista, Colo.
Potter Arthur, Ogden, Utah
Sheals, Ralph, Arlington, Va.
Stone, Clarence D., Tacoma, Wash.
Taylor, R. O., Ouray, Colo.
Torguy, Bruce, Porterville, Calif.
Tulley, Harlan N., Laramie, Wyo.
Veeder, J. S., Sandwich, Mass.
Whitsitt, Robert F., Milwaukee, Wis.

Junior Grade

Cohn, Sigmund S., Compton, Calif.
Congdon, E. A., Bismarck, N. D.
Davidson, Harold, East Lansing, Mich.
Field, Donald F., Billings, Mont.
Foster, Raymond E., Victoria, Canada
Haitsch, Leonard J., Saginaw, Mich.
Hamilton, Robert F., Chicago, Ill.
Henderson, Robert E., Petersburg, Alaska
Hoisington, Richard E., Petersham, Mass.
Imhof, Carl F., Seattle, Wash.
Krefting, Laurits W., St. Paul, Minn.
Lake, O. Warren, Rochester, N. Y.
Lehmer, Clayton B., Harrisburg, Pa.
Martin, Frank R., Jr., Necedah, Wis.
McFarland, William A., Wauna, Ore.
Murphy, Ellis, Seattle, Wash.
Poling, Arthur A., Bridgeport, W. Va.
Rou, Charles M., Hapeville, Ga.
Skoglund, A. Sydney, Spokane, Wash.
Smith, Hollis A., Vineyard Haven, Mass.
Snavely, David, Ono, Pa.
Stevens, Charles A., North Adams, Mass.
Strees, Leo V., Washington, D. C.
Wardell, M. Sterling, Polar, Mont.

Affiliate Grade

Corliss, John M., Greenfield, Mass.
Shea, Charles T., Waycross, Ga.

Associate Grade

Erickson, Taivo Andrew, Washington, D. C.
Libby, Clarence E., Syracuse, N. Y.
Van Rensselaer, Maunsell, Santa Barbara, Calif.

Resigned in Arrears

Member Grade

Clouston, John G., Pendleton, Ore.
Douglas, Lynn H., Denver, Colo.
Jensen, Everett J., Fairfax, Calif.
Jensen, Ralph, Fairfield, Idaho
King, Gordon S., Amherst, Mass.
Klotz, Alvin C., Mercer Island, Wash.
Lefkof, Emil A., Harrisburg, Pa.
Oliver, Tom K., Los Angeles, Calif.
Schultz, Edward W., Escondido, Calif.
Smith, L. Burl, Lyons, Ore.
Spears, A. Glenn, Shelby, Mich.
Stewart, George, Ogden, Utah
Touzeau, E. G., Nanoose Bay, Canada

Junior Grade

Conrow, Thomas M., Whittier, Calif.
Dunlap, Richard C., Portland, Ore.
Fisk, Carroll V., Kirksville, Mo.
George, Earl H., Oregon, Ill.
Helseth, Thomas P., Pendleton, Ore.
McIlvain, Ernest H., Jr., Woodward, Okla.
Quirin, Arthur F., Dallas, Ore.
Salter, James M., Jr., Swainsboro, Ga.
Servatius, William J., Utica, N. Y.
Walker, Herbert C., Syracuse, N. Y.

Affiliate Grade

Bolwerk, George, Kimberly, Wis.
Van Dyke, Emil M., Kimberly, Wis.
Wilson, Pleasant R., Lufkin, Texas

Associate Grade

March-Mount, Margaret, Hollywood, Calif.

Dropped for Nonpayment of Dues

Member Grade

Anderson, Lawson M., Helena, Ark.
Antonie, Alrick H., Lufkin, Texas
Aydelott, Owen L., Baker, Ore.
Baar, Charles F., Loudonville, N. Y.
Berry, John R., San Francisco, Calif.
Boeger, Harold, Colville, Wash.
Bond, Harrison F., Duxbury, Mass.
Bradford, Henry N., Canton, N. Y.
Brown, Kenneth B., Fredericton, Canada
Bucciarelli, Frank V., Gorham, N. H.
Davenport, Charles C., Ingalls, N. C.
deZeeuw, Carl Henri, Syracuse, N. Y.
Doe, Everett S., La Cresenta, Calif.
Drummond, Don M., Carson City, Nev.
Ferrell, Elvin K., Brookings, S. D.
Fowler, Carl W., Berkeley, Calif.
Fullerton, Samuel M., Glen Rock, Pa.
Granson, John E., Boone, Iowa
Griffin, Dan B., Front Royal, Va.
Grober, Dr. Samuel, Chicago, Ill.
Harp, Gordon, Yampa, Colo.
Harpp, Noble H., Warrensburg, N. Y.
Harrison, Ona A., Salt Lake City, Utah
Hobbs, Samuel M., Alhambra, Calif.
Holcomb, H. W., Malone, N. Y.
Howard, H. E., Decatur, Ga.
Ineson, Frank A., San Francisco, Calif.
Jacobs, Henry C., Park Falls, Wis.
Keogh, James A., Slayton, Minn.
Knight, Frank A., Yarmouth, Maine
Laidlaw, Alan F., Sturgeon Bay, Wis.
Lear, W. L., Crossett, Ark.
McCord, Paul P., Fort Collins, Colo.

McKillips, Robert L., Minden, La.
Muehleck, Frederick A., New York, N. Y.
Murray, Irvin Pat, Kanab, Utah
Nelson, Neal D., Washington, D. C.
Newton, Charles A., Spokane, Wash.
Nicholson, N. O., Grapeview, Wash.
Noble, Myrvin E., Cedar City, Utah
Parker, Alvin L., Gladstone, Ore.
Pettit, Charles C., Jr., Sylva, N. C.
Phillips, J. Elbert, Macon, Ga.
Piche, Gustave C., Montreal, Canada
Pilmer, Harold E., Atlanta, Ga.
Pogue, Ralph Winfred, Noel, Mo.
Reid, David Gene, Dallas, Texas
Reveal, Jack L., Pinecrest, Calif.
Robertson, Melvin L., Lapwai, Idaho
Roscoe, Arthur J., Red House, N. Y.
Sevy, Jay L., Price, Utah
Smith, Charles F., Fontana, Calif.
Snyder, Harry M., New Orleans, La.
Spaulding, T. C., Missoula, Mont.
Stathem, Paul, Porterville, Calif.
Stoneburner, William Henry, Charlottesville, Va.
Tropp, Charles C., Orono, Maine
Turpin, William E., Berry Creek, Calif.
Ventulett, David P., Ocala, Fla.
Vogler, Anton H., Russell, Pa.

Junior Grade

Amborn, Edward R., Foley, Minn.
Barkley, Robert E., Shelton, Wash.
Bartelt, Willord Edward, Charlestown, Ind.
Bell, John G., Lakefield, Canada
Bergeson, Kenneth H., Springfield, Ore.
Bibler, Gilbert S., Columbus, Ohio
Bland, Douglas K., Henderson, Ky.
Bowen, William L., Gran Quivira, New Mex.
Boynton, W. J., Jr., Tallahassee, Fla.
Castellani, William J., Brooklyn, N. Y.
Cherry, Parley E., Moscow, Idaho
Chilcote, William W., Corvallis, Ore.
Christiansen, Owen R., Susanville, Calif.
Cleveland, Grady G., Montgomery, Ala.
Clovis, Jesse Franklin, Orrville, Ohio
Colbert, Francis T., Phoenix, Ariz.
Cookinham, Walter S., Jr., Clinton, N. Y.
Cowan, W. Foster, Nashville, Tenn.
Daudistel, William Henry, Portland, Ore.
Daugherty, Rodman G., Columbus, Ohio
Day, E. Vance, Billings, Mont.
Doell, William R., Jr., Grand Rapids, Minn.
Donaldson, Perry O., Dell Rapids, S. D.
Dumas, Paul R., Rumford, Maine
Erickson, Arnold M., Grand Marais, Minn.
Erickson, Ralph L., Casa Grande, Ariz.
Feinberg, Bernard, Ann Arbor, Mich.
Fetty, Lester E., Green Cove Springs, Fla.
Fluckiger, Darrol T., Kemmerer, Wyo.
Forbes, Stanley E., Ridgway, Pa.
Forister, Thomas E., Cheyenne, Wyo.
Gashwiler, Robert N., Weed, Calif.
Glasgow, Leslie L., Baton Rouge, La.
Gnann, John W., Rincon, Ga.
Goldsberry, Walter M., Jr., Malvern, Ark.
Gould, Fred M., Madison, Wis.
Graham, George A., Jr., Johnstown, N. Y.
Grant, Donald L., Kosmos, Wash.
Griffin, Edward C., Thomasville, Ga.
Grothe, Charles H., Jr., Warrensburg, N. Y.
Guillaume, Harold B., Utica, Mich.
Habib, Philip C., Ottawa, Canada
Haigh, William S., Orange City, Fla.
Hall, Jack M., Moultrie, Ga.
Hanna, W. Howard, Morristown, N. J.
Hansen, Harvey L., San Jose, Calif.
Harrar, Russell D., Jr., Miffenburg, Pa.
Hays, Bert, Chattanooga, Tenn.
Henderson, Albert K., Centralia, Wash.
Hickok, David M., Swanton, Vt.
Hilfinger, George N., Detroit, Mich.
Hoffman, Charles H., Washington, D. C.
Hoffman, Edward J., Lame Deer, Mont.
Hollenbeck, George N., Cape Vincent, N. Y.
Howard, Edwin R., Lakeland, Fla.
Hubbard, Wayne G., Eugene, Ore.
Hudgens, Thomas A., Norris, Tenn.
Hunter, Howard C. A., Libby, Mont.
Hurt, Thomas L., Alhambra, Calif.
Jones, Edward E., Jr., Fernandina, Fla.
Jones, Mark F., Clarksdale, Ariz.
Kaden, Clarence E., Elmhurst, Ill.
Kareiva, Valentine V., Poland, N. Y.
Keefer, William O., Warren, Pa.
Kelsey, Floyd B., Fort Wayne, Ind.
Kennedy, Isaac C., Pooler, Ga.
Kick, Leslie W., Cortland, N. Y.
Kinder, M. T., Indianapolis, Ind.
Kischel, Robert E., Westfir, Ore.
Koll, Elmo J., Berkeley, Calif.
Kreher, Ernest W., Lakeland, Fla.
Lavinder, George W., Newman, Ga.
Leach, Edgar R., Mt. Clemens, Mich.
Leupold, Herbert M., Center Line, Mich.
Lunsford, Henry C., Gainesville, Fla.
Madden, Thomas M., Logan, Utah
Maddox, James W., Eminence, Mo.
Marcouiller, John, Merrill, Wis.
Martin, Robert A., Pittsfield, Mass.
Matt, Lester E., Webster Groves, Mo.
Mazzetta, A. J., Magdalena, New Mex.
McGillivray, John O., Weston, Mass.
Melrose, Roger M., Portland, Ore.
Mendel, Joseph J., Milwaukee, Wis.
Mitchell, Robert W., Scottsburg, Ind.
Mongold, Lloyd H., Fort Collins, Colo.
Mooney, Robert Lee, Fort Wayne, Ind.
Morgan, Robert S., Sandpoint, Idaho
Nelson, Harold A., Plymouth, N. C.
Nelson, Kenneth E., Van Nuys, Calif.
Neumann, Paul O., Jemez Springs, New Mex.
Nevers, John R., Valdosta, Ga.
Nicholson, John D., Bangor, Maine
Nigro, John F., Millbrook, N. Y.
Noneman, Robert L., Darlington, S. C.
Parker, F. C., Greenwood, S. C.
Patton, Albert C., Bastrop, La.
Perry, Robert F., Avon, N. Y.
Pikes, Charles C., South Charleston, W. Va.
Poole, John W., Walterboro, S. C.
Pour, George E., Orland Park, Ill.
Rex, John C., Irvona, Pa.
Richter, Walter J., Jr., Savannah, Ga.
Roberts, Dale E., Indianapolis, Ind.
Roberts, Earl C., Duchesne, Utah
Robertson, Richard J., Camden, S. C.
Seymour, Zack L., Newman, Ga.
Shields, Merlin James, Los Angeles, Calif.
Shillen, Francis G., Clearfield, Pa.
Sigler, Carlys C., Grant, La.
Smith, Kenneth O., Jr., Willits, Calif.
Sosbe, Edward H., Hampton, Ark.
Stanton, Bruce T., Syracuse, N. Y.
Stratton, Clyde H., Riverside, Calif.
Sudduth, Henry L., Jr., Chipley, Fla.
Sullivan, Gerald J., Minneapolis, Minn.
Terrell, Noble K., Tampa, Fla.
Thigpen, Doyle, Franklinton, La.
Thomas, Walter P., Homer, La.
Thomson, Karl G., St. Maries, Idaho
Trenholm, Raymond L., Lacomb, Ore.
Twombly, Gray M., Paul Smiths, N. Y.
Van Pelt, M. B., Philadelphia, Pa.
Veenschoten, John C., Erie, Pa.
Verkler, Richard S., Columbus, Ohio
Veverka, Ralph, Cleveland, Ohio
Walker, E. Scovell, Plain Dealing, La.
Webb, Walter E., Wichita Falls, Texas
Welch, John C., East Millinocket, Maine
Wiener, Alfred A., Eugene, Ore.
Williams, Charles E., Savannah, Ga.
Wilson, John Wilbur, Clearfield, Pa.
Wilson, O. Frank, Jr., Dallas, Texas
Wismer, Robert E., Royal Oak, Mich.
Wright, John Peter, Bergenfield, N. J.
Wright, Lewis E., Hollywood, Calif.
Young, John P., New Orleans, La.
Youngs, George J., Black River, N. Y.
Zimmerman, Richard O., Syracuse, N. Y.
Zurney, Walter E., Manorville, Pa.

Affiliate Grade

Bousquet, Donald E., Saranac Lake, N. Y.
Gilbert, Page M., National, Wash.
Harris, Lew W., Lakeview, Ore.
Hope, Louis, Blackduck, Minn.
Kennedy, Donald P., Oakdale, La.
Lawson, Rex Ryan, Eveleth, Minn.
Martin, Lewis R., Broaddus, Texas
Muiry, James M., Wilmington, N. Y.
Olson, Alver J., Burney, Calif.
Olson, Ernst B., Parsons, W. Va.
Parmeter, Dean, Littlefork, Minn.
Shellenbarger, Everett L., North Fork, Calif.

Associate Grade

Green, Dr. William E., Winona, Minn.
Greenwood, Sam Kelly, Lufkin, Texas
Komarek, Edwin V., Thomasville, Ga.
Smith, V. Edgar, Woodworth, La.
Snyder, Kathleen M., Columbus, Ohio
Titus, Harold, Traverse City, Mich.

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Forestry News

American Forestry Association Elects New Officers

Don P. Johnston of Wake Forest, N. C., has been elected president of the American Forestry Association. He succeeds D. C. Everest of Marathon, Wis., not a candidate for re-election, who becomes a member of the board of directors.

Johnston has been active in forestry work for many years. He retired from the U. S. Forest Service in 1919. He served as president of the North Carolina Forestry Association from 1948 through 1951, and has been a member of the AFA's board of directors since 1947. He becomes the twenty-third president of the 77-year old organization. John M. Christie, of Washington, D. C., was reelected treasurer.

Seven new directors in addition to Mr. Everest elected to fill out the association's 16-man board include:

Bryce Browning, New Philadelphia, Ohio, secretary-treasurer, Muskingum Watershed Conservancy District.

Erle Cocke, Atlanta, Ga., president, The Fulton National Bank.

Dr. Wilson Compton, Washington, D. C., Department of State.

Miss Marie E. Gaudette, New York, nature adviser, program department, Girl Scouts of the United States of America.

Dr. Elmer G. Peterson, Logan, Utah, managing director, Utah Research and Development Foundation.

Robert W. Sawyer, Bend, Ore., editor, *The Bend Bulletin*.

Hebert W. Voorhees, Trenton, N. J., president, New Jersey Farm Bureau.

Twenty-one honorary vice-presidents elected were:

Sherman Adams, Concord, N. H., Governor of New Hampshire; G. E. Condra, Lincoln, Neb., dean, conservation and survey division, University of Nebraska; Ed Dodd, Atlanta, Ga., "Mark Trail" cartoonist; Stanley G. Fontanna, Ann Arbor, Mich., dean, School of Natural Resources, University of Michigan; Walter K. Granger, Cedar City, Utah, member of Congress. W. B. Greeley, Seattle, Wash., vice-president, West Coast Lumbermen's Association; William L. Hall, Hot Springs, Ark., consulting forester; Palmer Hoyt, Denver, Colo., editor, *The Denver Post;* Evan W. Kelley, Missoula, Mont., former regional forester; E. L. Kurth, Lufkin, Texas, president, Southland Paper

Don P. Johnston

Mills, Inc.; Kent Leavitt, Millbrook, N. Y., farmer; James G. K. McClure, Asheville, N. C., president, Farmers Federation; G. B. MacDonald, Ames, Iowa, professor of forestry, Iowa State College; Walter H. Meyer, New Haven, Conn., professor of forest management, Yale School of Forestry; Lloyd E. Partain, Philadelphia, Pa., manager, Commercial Research Division, The Curtis Publishing Company; Cornelia Bryce Pinchot, Milford, Pa., conservationist; W. A. Roberts, Milwaukee, Wis., president, Allis-Chalmers Manufacturing Company; W. S. Rosecrans, Los Angeles, Calif., chairman, California State Board of Forestry; A. C. Spurr, Fairmont, W. Va., president, Monongahela Power Company; William P. Wharton, Groton, Mass., president, National Parks Association; and Chester S. Wilson, St. Paul, Minn., commissione of conservation.

Bankers Forestry Program

Included in the agricultural program of the American Bankers Association is a forestry program, described in a recent publication, *A Program for Country Banks*, published by the Agricultural Commission of the association.

A forestry committee has been established within the commission with the following members: George G. Ware, chairman, First National Bank, Leesburg, Fla.; Frank W. Black, Peoples National Bank, Barre, Vt.; M. E. Cooper, Bank of Wiggins, Wiggins, Miss.; L. S. McReady, First National Bank, Eugene, Ore.; and J. Douglas Turner, First National Bank, Paintsville, Ky. Dr. Lippert S. Ellis, dean and director, College of Agriculture, University of Arkansas, Fayetteville, is adviser to the committee.

Similar committees of the Bankers Association are concerned with youth activities, soil conservation, livestock, farm land prices, agricultural lending procedures, outside farm programs, farm credit schools, G.I. farm loans, agricultural outlook, and research in farm credit.

Vaux Named Editor American Forestry Series

After 17 years of leadership Walter Mulford, dean emeritus of the School of Forestry, University of California, has resigned as consulting editor for the American Forestry Series. Professor Mulford's duties have been assumed by his colleague Henry J. Vaux, associate professor of forestry at the University of California.

In making public the change, the McGraw-Hill Book Co., Inc., publishers of the American Forestry Series, released the following statement by Professor Mulford:

It is now 17 years since the first volume of the American Forestry Series was issued. Twenty-three volumes have been published. Now there comes, quite appropriately, a change in the consulting editorship.

It is believed that the series has played a constructive part in the work of the forestry schools in training men for the profession. The many authors, and the many more persons who have assisted the authors in various ways, all have a share in the influence of the texts on the development of the profession.

The new leadership of the series is in most competent hands. Professor Vaux knows at first hand the needs of the classroom. He is highly skillful in meeting those needs.

Professor Mulford's energetic activity in behalf of education and scholarship in forestry has made his name among the best-known of American foresters. The extensive list of books published under his sponsorship promises to endure as testimony to his professional stature and editorial wisdom.

Professor Vaux, a 1933 graduate of Haverford College, was awarded the Ph.D. degree by the University of California in 1948. He is well known for his original work in the economics of forestry and forest products.

Insurance for a 3 Billion Dollar Lumber Market

A new publication, *Insurance for a 3 Billion Dollar Lumber Market*, calls attention to the role of industrial research in the competition for markets. It outlines the research activities of companies and associations both within and outside the lumber industry.

The lumber industry, through its Committee on Products and Research, is now engaged in a three-fold program of research: 1. Hardwood research; 2. Railroad crosstie research; and 3. Dimensional stabilization research.

It is pointed out that the Timber Engineering Company over the past 18 years, at no expense to the lumber industry, but with funds derived from sales of its own products, has spent $816,000 in research and engineering, and $2,650,000 in sales promotion and advertising to help the lumber industry hold old markets and to develop new sales outlets. It now has in Washington, D. C. a research laboratory valued at $160,000 and staffed with 25 research workers.

The publication is available through the National Lumber Manufacturers Association, 1319 18th Street, N. W., Washington 6, D. C.

Masonite Motion Picture

Masonite Magic at Ukiah, a 16-millimeter color and sound film telling the story of hardboard production at the new plant of Masonite Corporation in Ukiah, Calif., is being shown in western communities. The company's western salesmen are handling bookings in their own territories. Groups east of the Rockies may request the film for free showings by contacting the Chicago office well in advance of the desired date.

The visitor shown in the movie, which runs 23 minutes, is received in the office of E. T. F. Wohlenberg, vice-president and plant manager. There he receives a briefing on his trip. A guide then escorts him into the company's forests by way of the fabulous 35-mile access road. He witnesses the selection and cutting of timber, debarking, and hauling.

Returning to the plant, the visitor first visualizes the production of hardboards on a laboratory scale so that the actual processes will be more meaningful. Various steps in the manufacturing process are shown from the conversion of logs into chips to the final steps of inspection, wrapping, and shipping.

U. S. Nursery Taken Over by West Virginia

The West Virginia Conservation Commission has leased the federal tree nursery at Parsons. It has an annual capacity of 6,000,000 trees. The commission will continue to operate its own plant at Lesage, which has a capacity of 3,000,000 seedlings.

Under the lease, in the form of a memorandum of understanding effective for 15 years, the commission will have use of all buildings and equipment and of the 100 acres of land for the production of trees. In return, it agrees to supply the U. S. Forest Service annually up to 1,000,000 trees at cost of production for planting and will pay up to $90 annually as its share of maintenance of a surfaced road crossing the area. Protection of the area against forest fires is assumed by the commission.

The Secretary of Agriculture reserves the right to terminate the lease at any time if this should be required in the public interest. Provision is made for renewal of the lease, on mutually satisfactory terms, on its expiration in 1966.

FIRST CHOICE FOR USE IN ROUGH COUNTRY... KING

Complete Front-Mount Winch Assembly

The KING Model 100 power-take-off driven Complete Front-Mount Winch Assembly, pictured above on a Willys Station Wagon, is being demonstrated before high government and military officials in France, during the North Atlantic Pact military demonstrations.

Designed and engineered primarily to help geophysical crews get in and out of rough locations. KING Winches are in wide use throughout the world clearing the trail and keeping rolling stock moving.

In recent years KING Winch Assemblies have proved exceptionally useful to the men in the Forestry Service. Many State Forestry Departments and Federal Branches have approved KING Winches after exhaustive performance tests and price comparisons. Hundreds now serve Ranger Stations throughout the country.

Whether crankshaft driven for 3-speed transmissions or power-take-off driven for 4-speed transmissions, as shown above, KING Winches are "factory-fit" assemblies for Willys, Ford, Chevrolet, GMC and some Dodge trucks.

The result of 19 years of leadership in front-mount winch manufacturing and engineering, KING Winches are lightweight, properly balanced and ruggedly braced for years of active Forestry service.

Write for bulletins on KING Complete Front-Mount Winch Assemblies to fit your trucks.

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Forest Management Policy Adopted by Woodworkers (CIO)

At its annual convention in Denver, Colo., October 1-5, 1951, the International Woodworkers of America (CIO) adopted the following forest management policy:

WHEREAS: The international situation underlines the imperative necessity of a better conservation policy for our forest; and

WHEREAS: The last stands of timber suitable for plywood and heavy construction, located in the northwest, are now being cut in a destructive manner. Similar methods are proposed for Alaska. Our saw timber supplies are being depleted one and a half times as fast as they are growing; and

WHEREAS: Any prolonged military preparedness effort, such as now seems inevitable, will rapidly deplete our remaining supplies, interfere with defense production, hamper efforts to provide housing in connection with new plants and city dispersion, result in rapid increases in prices, and reduce us to a risky dependence on other countries; and

WHEREAS: This is a shameful situation for the nation which once boasted the greatest forests in the world, and a situation which need not have arisen, and which can be corrected by proper action; now

THEREFORE BE IT RESOLVED: The Fifteenth Annual Convention of the International Woodworkers of America reaffirm our position that the following are the steps needed to get our forests into productive condition:

1. Federal legislation providing for direct federal regulation of all cutting on private timber lands everywhere, such regulation to be on the principles of sustained yield, selective cutting, multiple use, and intensive management.
2. The provision of technical and financial assistance to small timber land owners and operators on condition of proper management.
3. An end to the so-called sustained-yield units.
4. The rapid expansion of timber access roads.
5. The preservation and development of the old-growth forests of the Pacific Northwest and Alaska on a long-rotation, selective-cutting, individual tree-marking basis which will perpetuate the plywood and structural timber industries.
6. The rapid extension of the natural forest system by interior and exterior purchases.
7. The establishment of a national redwood forest.
8. Experimentation in public purchase of managerial rights in private timber lands.
9. Much more public credit for forestry.
10. The use of agricultural aids for forestry.
11. Much larger appropriations for our forest conservation and cultivation activities.

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STORY OF
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Bausch & Lomb Zephyr-Light 7x, 35mm Binocular Balcoted Optics $155, plus tax
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Binoculars

Forest Products History Foundation Program

A revitalized program of services to persons concerned with preserving factual information on the past, present, and future of the forest products industry has been announced by The Forest Products History Foundation, affiliated with the Minnesota Historical Society.

A new brochure, *Retracing the Blazed Trail*, tells the purpose and plans of the foundation and describes the functions outlined by its national advisory board. Henry Schmitz, University of Minnesota, is chairman of the advisory board.

Program items include: establishing a bibliography of the American forest products industry; collecting and preserving records of the industry; providing a record service program; developing a publication program; writing company histories; promoting an educational program.

Copies of the brochure may be obtained from the foundation's headquarters, Minnesota Historical Society, St. Paul 1.

Radio Sets Off Blasting Caps

Conservation Director Ernest Swift has relayed a message to Wisconsin Conservation Department supervisors and field men warning that electric blasting caps can be set off by radio transmitters. The fact that such accidents can happen has been established by the DuPont Company.

Field men occasionally handle electric blasting caps and also have fixed and mobile radio transmitters, opening the way to possible accidents. The department men were advised to keep the caps at least 100 feet away from the 10 to 100 watt transmitter, 300 feet away from a 100 to 500 watt transmitter, and a quarter of a mile away from a transmitter of 500 watts or more.

Norman J. Penick (1906-1951)

Norman J. Penick, staff member of the regional office, U. S. Forest Service, Portland, Oreg., died December 11 after an illness of a few hours.

Since May 1950, Penick had directed the work of collecting information in Oregon and Washington on conservation practices and management improvements needed on forest and range lands. This work is part of the project to design a conservation plan for the Columbia basin.

NORMAN J. PENICK

He was stricken while at work, and died about 3 hours later. He was 45 years old.

Before his appointment to the regional staff, Penick had 16 years experience with the Forest Service. He worked on the Gifford Pinchot, Mt. Hood, Rogue River, Ochoco, and Chelan national forests and was supervisor of the Chelan National Forest from 1943 to 1946 and the Mt. Hood National Forest from 1946 until 1950.

A native of Yakima, Wash., Penick received a B.S. degree in forestry from the University of Washington in 1931 and a master of forestry degree from New York State College of Forestry in 1932.

Midwestern Shade Tree Conference

The 7th annual meeting of the Midwestern Chapter of the National Shade Tree Conference will be held February 13 to 15, at the LaSalle Hotel, Chicago. Problems of concern to those who are interested in the maintenance of ornamental trees and shrubs will be discussed. The convention is open to all who wish to attend.

Important McGraw-Hill Books

FORESTRY AND ITS CAREER OPPORTUNITIES

By HARDY L. SHIRLEY, State University of New York. *American Forestry Series.* Ready in August.

Here is an interesting new text which is designed to orient the reader in the field of forestry. It sketches the historical background of forestry on a world-wide and nationwide basis, the recent progress made in the United States, and the outlook for the future. It presents situations which the forester is likely to face throughout his entire career in both the technical and policy fields.

ECONOMIC BOTANY. New 2nd Edition

By ALBERT F. HILL, Harvard University. *McGraw-Hill Publications in the Botanical Sciences.* 560 pages, $7.00.

Evaluates the many changes brought about in agricultural and forest practices as a result of the Second World War—greater production of food, increased acreage, improved methods of cultivation and harvesting, and the introduction and establishment of foreign plants into the Western hemisphere. Substitutions are also considered as well as the use of virtually unknown plants.

FOREST ENTOMOLOGY. New Third Edition

By S. A. GRAHAM, University of Michigan. *American Forestry Series.* Ready in March

Presents the techniques of forest insect control and the underlying principles of forest entomology with emphasis on the practical and ecological aspects of the subject. Principles are illustrated by a full discussion of representative species selected from each important ecological group of forest insects. Forest entomology is presented as an integral part of forest practice.

TEXTBOOK OF WOOD TECHNOLOGY. Volume 2. The Physical, Mechanical and Chemical Properties of the Commercial Woods of the United States

By H. P. BROWN, State University of New York; A. J. PANSHIN, Michigan State College; and C. C. FORSAITH. *American Forestry Series.* Ready in March

The companion volume to *Structure, Identification, Defects, and Uses of the Commercial Woods of the United States,* this text is divided into three parts which treat the physical, mechanical, and chemical properties of commercial woods. Derivations of almost all of the equations used in measuring the physical and mechanical properties of wood are given. Recent advances are included.

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Hilton Retires from U.S.F.S.

The retirement of Huber C. Hilton, assistant regional forester in charge of the division of personnel management, Rocky Mountain region of the U. S. Forest Service, was effective December 31, after more than 40 years of continuous employment with the Forest Service. He was one of the small group of pioneer foresters who contributed most to our present system of national forests.

Preceding his graduation in forestry from Michigan State College in 1911, Hilton served as temporary field assistant on the Gunnison and Bighorn National Forests. His first regular appointment to the Forest Service was in November 1911, when he was made forest assistant on the old Colorado National Forest.

Various transfers in the next five years, as forest examiner, gave him experience on forests in Colorado, South Dakota, and Michigan. In 1916 he was made supervisor of the Michigan National Forest. He remained there until the spring of 1921, when he became supervisor of the Medicine Bow in Wyoming. He was brought into the regional office in Denver in

A Jafay Portrait

HUBER C. HILTON

1934, and soon after appointed as regional forest inspector. He was subsequently promoted to chief of the division of recreation and lands; and in 1944 shifted to his present position as regional chief of personnel management.

A Member of the Society of American Foresters since 1919, he has long been active in Society and professional affairs.

Albert A. Legett (1904-1951)

Albert Arlin Legett, 47, state forester of Mississippi, died suddenly of a heart attack on December 13, at Gulfport, Miss. He had been in attendance at the annual meeting of the Society of American Foresters at Biloxi.

Mr. Legett, a native of Mississippi, had served as state forester since September 1941. In 1928 and 1929, he was employed as manager of the Mississippi Nurseries, and in the latter year became superintendent of buildings and grounds at Mississippi Southern College, where he also taught horticulture. From 1933 to 1935, Mr. Legett was silvicultural foreman for the Mississippi Forestry Commission and Civilian Conservation Corps, leaving in 1935 to enter the federal service. Until 1941 he was superintendent of CCC camps for the Soil Conservation Service. Since September 1941 he had again been employed by the Mississippi Forestry Commission as state forester and park director.

Born in Rankin County, Mississippi, on October 6, 1904, he attended both Mississippi State College and Louisiana State University. He was an Associate Member of the Society.

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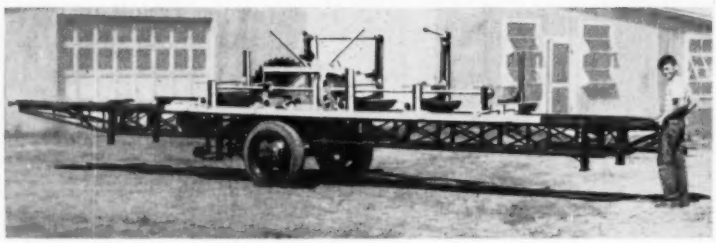

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Claridge Named State Forester of North Carolina

Director George R. Ross of the North Carolina Department of Conservation and Development announced on December 7 the appointment of Fred H. Claridge as state forester of North Carolina.

Claridge for the last six months has been acting as administrative assistant to the director of the department and prior to that time he was in charge of the forest management work in North Carolina. He inaugurated the state's nursery and planting program in 1925 and during 1933-37 was director of Civilian Conservation Corps activities in the state.

A native of New Haven, Conn., Claridge received his master's degree in forestry from the Yale School of Forestry in 1924. He is a member of the Society of American Foresters, and in 1937 was chairman of the Appalachian Section of the Society.

Fritz Named Top Performer, 1951

Emanuel Fritz, professor of forestry, University of California, and recently elected Fellow, Society of American Foresters, was named one of the "Top Performers of 1951" by *Fortnight*, California's news magazine.

In making the citation, the editors said, "Dr. Fritz is generally known off campus up in the redwood country as 'Mr. Redwood.' As forestry consultant to the California Redwood Association he has pioneered much of the way to scientific forestry practices among the redwood lumbermen. The 'Tree Farm' program in the redwood country is a pet project of his and is designed to solve the terrible riddle of how to use our forest resources and have them at the same time."

Forest Farmers to Meet in Chattanooga

Chattanooga, Tenn. has been selected as the site of the 1952 Southern Forestry Conference of the Forest Farmers Association.

The 1952 meeting will start Thursday morning, March 27, and will conclude with a banquet on Friday night, March 28. Hotel Patten will be conference headquarters, with the Read House and others cooperating to handle the anticipated 350 to 400 participants.

Association President W. M. Oettmeier, who is also president of Superior Pine Products Company of Fargo, Ga. and a member of the U. S. Chamber of Commerce Forestry Committee, noted that this year's theme will be a dual one featuring discussions on maximum utilization of wood waste and timberland taxation problems as they affect all forest land owners.

All hotel reservations are being handled by J. T. Halliday, director of Chattanooga, Inc., the convention bureau of the local Chamber of Commerce.

The Forest Farmers Association now lists some 1,300 members, who own over 13,000,000 acres of forest land.

Curtis Companies Purchase American Plywood Corporation

George M. Curtis, president of Curtis Companies, Inc., Clinton, Iowa, has announced the purchase, as of December 21, 1951, of American Plywood Corporation of New London, Wis, and its wholly owned subsidiary, American Veneer Corporation, Oconto, Wis. All capital stock of American Plywood has been purchased outright, including all real estate, equipment, timberlands, contracts for logs, patents, trade names, and other assets.

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Forestry College Names 4 New Staff Members

Two men have been appointed to the faculty and two others to the research staff at State University College of Forestry, Syracuse, N. Y. The appointments bring the faculty to 64 and research staff to 35.

Kenneth C. Compton, previously assistant professor in forestry at University of Missouri, has been named assistant professor in the Department of Forest Utilization. New additions to the Department of Pulp and Paper Manufacture include: Daniel V. Lent, Auburn, N. Y., instructor; Donald W. Libby, Syracuse, research associate; and Harold Hickson, Bangor, Me., technical assistant.

Compton, a native of Seattle, received his B.S. degree from Iowa State College in 1936 and his M.S. from the College of Forestry, Syracuse, in 1938. He was employed previously by Gulf States Creosoting Co., Hattiesburg, Miss.; A. W. Williams Timber Inspection Co., Mobile, Ala.; Rust Engineering Co.; and Flintkote Co., Meridian, Miss., and went to the University of Missouri in 1947.

A 1948 graduate of the College of Forestry, Syracuse, Lent received his M.S. degree there in 1950. He was an assistant professor in the Chemistry Department of Western Michigan College, Kalamazoo, during the 1950-51 school year. He previously worked for Hammermill Paper Co., Erie, Pa.

Libby, University of Maine 1943, is working on the college-industry sponsored hardwood pulping project. He was formerly employed by Oswego Falls-Sealright Corp., Fulton, N. Y.; and Solvay Process Division of Allied Chemical and Dye Corp., Syracuse.

Hickson is a 1951 graduate of the University of Maine and is also employed on the hardwood pulping project. He previously worked for American Sales Book Co. and St. Regis Paper Co., Bucksport, Me.

Walter O. Filley Honored

An award for "outstanding work in conservation" was presented to Walter O. Filley, forester emeritus of The Connecticut Agricultural Experiment Station, by the Connecticut Outdoor Writers' Association on November 29, 1951. Mr. Filley was one of five men so honored at the second annual Connecticut Conservation Conference of the Natural Resources Council of Connecticut, held in Hartford.

Mr. Filley had held the post of forester at the Connecticut Station for 39 years, during 33 of which he was chief forester. As station forester, he was also state forester and fire warden until 1921, when the General Assembly created a separate post of state forester. During the period 1912 to 1921, he enlarged the four existing state forests and acquired a fifth.

One of his most significant contributions to Connecticut has been his long and active membership in the State Park and Forest Commission, which was established in 1913. For 20 years, he served as treasurer of the commission, and for several years afterwards as secretary.

He was a pioneer in the movement for improving care of shade trees. In 1919 the Assembly created the Connecticut Tree Protective Examining Board, first in the country. He was an active member and secretary for 26 years. From the board grew the Connecticut Tree Protective Association, of which Mr. Filley was secretary for 13 years. Largely the result of Connecticut's pioneering in this phase of conservation is the National Shade Tree Conference, of which Mr. Filley has served as secretary, vice-president, and president.

The Connecticut forester emeritus is a member of the Society of American Foresters, the American Forestry Association, and the Connecticut Forest and Park Association. He is a Fellow of the American Association for the Advancement of Science.

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Personnel Changes in Forest Pathology

The following personnel changes have been made in the Division of Forest Pathology of the Bureau of Plant Industry, Soils, and Agricultural Engineering: C. Audrey Richards, in charge of its research on the deterioration of wood products at the Forest Products Laboratory, has retired after 34 years of service. Ralph M. Lindgren, formerly in charge of its investigations in cooperation with the Southern Forest Experiment Station, replaces C. A. Richards, and Arthur F. Verrall has taken over the studies of wood deterioration in the South. Paul V. Siggers has retired after 30 years of research mainly on diseases of the southern pines, and is replaced by Berch W. Henry, Harrison Experimental Forest, Saucier, Miss.

Data on Beech Wood Published

The first in a series of publications aimed to help the wood-using industries make better use of beech wood is a 17-page booklet, *Some Physical and Mechanical Properties of American Beech*. It is one of several publications planned on beech wood by the Northeastern Forest Experiment Station in cooperation with the Northeastern Technical Committee on the Utilization of Beech.

The technical committee, including representatives of federal and state forestry agencies, universities, and state experiment stations, was organized a few years ago.

The first paper in the series, written by Benson H. Paul and John T. Drow of the U. S. Forest Products Laboratory, Madison, Wis., describes the basic physical and mechanical properties of beech wood. Other papers in the series will contain information about chemical properties and uses of beech; management of beech; markets and supply; logging, storage, seasoning, milling, and fabrication of beech; and use of beech wood in various products such as flooring, furniture, veneer, turnings, novelties, containers, wood pulp, and charcoal.

The project is directed and coordinated by a working committee consisting of David B. Cook, New York State Conservation Department; Claude Bell, U. S. Forest Products Laboratory; Raymond J. Hoyle, College of Forestry of the University of the State of New York; Fred Wangaard, Yale University School of Forestry; and Fred C. Simmons and C. R. Lockard of the Northeastern Forest Experiment Station.

RUSSELL K. HALLBERG, *above*, has been appointed instructor in forestry at the University of the South, Sewanee, Tenn.

Mr. Hallberg was born in Chicago, attended public school in Skokie, Ill., and upon completing high school entered the University of Wisconsin. He served in the Army in World War II in the European theater of operations. Upon return from military service, he entered the University of Idaho and obtained his B.S. in Forestry at Michigan State College in 1949. During the summer of that year he began working as a forest assistant in the Duke Forest, and received the M.F. degree from Duke University School of Forestry in 1950. Mr. Hallberg then trained for lumber inspection work with the Southern Pine Inspection Bureau at the Southern Pine Lumber Company, Diboll, Tex.

At the University of the South Mr. Hallberg instructs courses in forest and wood utilization, wood technology, and forest products industries.

Bleached Groundwood Pulp Produced at M and O Mill

Using a bleaching process developed by the E. I. du Pont de Nemours & Company, Inc., the Minnesota and Ontario Paper Company's plant at International Falls, Minn. began the production of bleached groundwood pulp in November 1951.

For the first time in the company's history, 100 percent bleached pulp was used in the manufacture of paper on all three machines at the International Falls division. However, Mando has been bleaching its kraft and sulphite pulp for nearly two years. The groundwood bleachery is part of Mando's six-year modernization program, designed to give Mando greater product diversification and greater production. So far, $17,000,000 has been spent on modernization and plant improvements.

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Colorado, Nevada, Wyoming, Join Tree Farm Program

The American Tree Farm System welcomed three new member states as 1951 drew to a close. They were Colorado, Nevada, and Wyoming. The three states bring national Tree Farm enrollment to 33.

Nevada's first certificates went to Fibreboard Products, Inc., owners of the 12,784-acre Floriston Tree Farm in Washoe County, and Sierra Pacific Power Company's Tahoe-Sierra Tree Farm of 14,460 acres. Only 200 acres of this property are in Nevada.

Colorado's first Tree Farm certificate went to Broderick Wood Products Co., of Denver, for a 3,200-acre woodland tract in Larimer County.

Wyoming's first Tree Farm is a 240-acre tract in Carbon County owned by N. A. Swenson, coal and woodland operator.

All four properties were inspected and approved by the Western Pine Association's forest practices committees. Certification announcement was made in Portland, Ore., by E. L. Kolbe, chief forester for the association. District forest engineers helping process applications were Ralph Hodges, for the Nevada area, and Arthur T. Upson, for Colorado and Wyoming.

Vico C. Isola (1890-1951)

Vico C. Isola, 61, assistant regional forester, U. S. Forest Service, Milwaukee, Wis., died December 4, 1951. He had been ill for nine weeks. He had been in charge of the regional information and education program since 1941, and was one of the founders of the Trees for Tomorrow camp at Eagle River, Wis.

He was born in Pepperell, Mass., and was graduated from Tufts College and the Yale School of Forestry. From 1914 to 1927 he worked as cruiser, woods superintendent, and sales manager for lumber companies in New England, and from 1927 to 1933 he was executive secretary for the Maine Development Commission.

He joined the U. S. Forest Service in 1934 and worked in various assignments in the national forests of New England until 1936 when he was transferred to Washington, D. C. to the division of state and private forestry. Following the Atlantic coast hurricane of 1938, he was assigned for two years to the state-federal cooperative timber salvage project headquartered at Boston.

Advertisements to Feature Tree Farms and Wood Utilization

To acquaint the American public with the steps being taken by forest industry to assure the nation of a perpetual timber supply, Weyerhaeuser Timber Company has inaugurated a series of national magazine advertisements telling the story of tree farms and wood utilization. Starting with January issues, Weyerhaeuser's full-color page advertisements will appear monthly in the *Saturday Evening Post*, *Farm Journal*, and *U. S. News and World Report*.

In order to get the reader "into the woods" logically and quickly, the advertisements picture the wildlife which abounds on the tree farms of the Pacific Northwest. Illustrators are Fred Ludekens and Stan Galli, both of whom have lived in the state of Washington and have an appreciation of the area's forests and wildlife.

The forthcoming national advertising campaign is an extension of Weyerhaeuser Timber Company's Pacific Northwest public information program. For several years the company has made use of newspaper and radio advertising to explain its operating policies to the people of the Pacific Northwest, particularly where Weyerhaeuser operations have a direct effect on the economics of a community.

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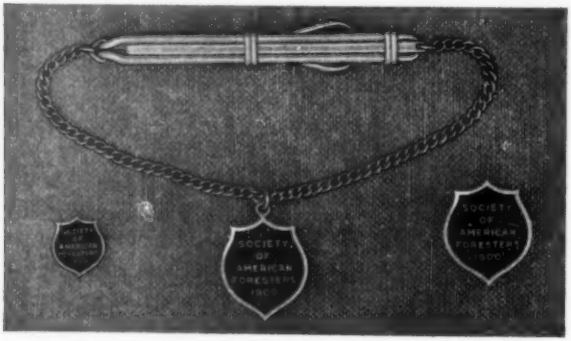

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Rocky Mt. Personnel Changes

Russell B. McKennan, supervisor of the Pike National Forest since 1946, was promoted to the position of assistant regional forester in charge of the Division of Personnel Management, Rocky Mountain region of the U. S. Forest Service, at Denver on January 1. He succeeded Huber C. Hilton, who retired after more than 40 years with the Forest Service.

RUSSELL B. MCKENNAN
New Personnel Chief

ROY L. WILLIAMS
New Fire Control Chief

A native of Nebraska and graduate in forestry from Iowa State College, McKennan joined the Forest Service in 1924. He was succeeded as supervisor on the Pike Forest by Raymond E. Phillips, formerly assistant chief of the regional Division of Recreation and Lands. Wilfred S. Davis, in charge of fire control for the regional office, succeeded Phillips.

Roy L. Williams, supervisor of the Bighorn National Forest, took over the important position of chief of fire control for the entire Rocky Mountain region at the same time.

Graduate Study and Assistantships at Yale

A number of fellowships, scholarships, and assistantships will be available for 1952-53 for qualified graduate students who desire to pursue courses of study leading to the degree of Master of Forestry (M.F.), Doctor of Forestry (D.For.), or Doctor of Philosophy (Ph.D.). In the case of assistantships, consideration will also be given to qualified men who may wish to carry on part-time programs of study without reference to a degree.

A limited number of fellowships, with stipends ranging from $500 to $1,200, will be offered. Such awards are generally restricted to students taking the final year of the Master of Forestry program and to those working toward the doctorate. Recipients of fellowship awards will be required to pay tuition charges and such laboratory fees as may be involved in their particular programs of study. However, no assistance in teaching or research or other service is required.

Several scholarships are available for deserving applicants. These cover the cost of tuition only.

A number of research assistantships are available in connection with a long-range study of the properties of tropical woods. These may involve either half-time work on the project (and half-time study for a degree) at a rate of pay of $125 per month during the academic year, or up to 10 or 12 hours of work per week at an hourly rate of pay. Prior experience or training in wood technology is not a prerequisite for an assistantship, and appointments will not necessarily be restricted to students specializing in wood technology.

Students receiving assistantships will be required to pay tuition charges and laboratory fees, but tuition charges are reduced by almost one-half for assistants working on a half-time basis.

Applications for fellowships, scholarships, and assistantships for 1952-53 should be filed by March 1, 1952. Application blanks for fellowship and scholarship aid and for admission may be obtained from the Registrar, Yale School of Forestry, 205 Propect Street, New Haven 11, Connecticut. Men interested in assistantships should correspond with the dean at the same address.

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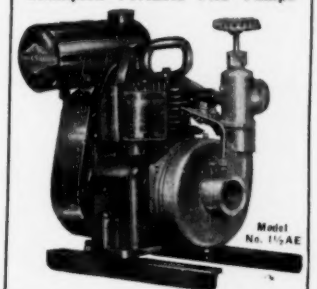

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Peavy Memorial Proposed

Friends and associates of George W. Peavy, former dean of the School of Forestry, Oregon State College (1910-1934) and past president of Oregon State College (1934-40), are initiating a drive for a Peavy Memorial Fund. The proceeds received will be used to establish a Student Loan Fund at Oregon State College for the benefit of undergraduate forestry students.

Peavy, who died in Corvallis, Ore., on June 24, 1951, at the age of 81, started the Oregon State College School of Forestry in 1910. Well-known in Oregon's forestry ranks, the dean contributed a lifetime of service to the forestry profession and to civic life in his region. Peavy was particularly interested in American youth and had abiding faith in its abilities to solve the nation's economic and social problems.

Descriptive material on the Memoria Fund proposed can be obtained from Ray Yoder, Forestry School Alumni Association, School of Forestry, Corvallis, Ore.

Kelly Named Secretary West Virginia Council

The resignation of West Virginia's assistant state forester, Asher W. Kelly, Jr., and the appointment of Frank O. Frazier to succeed him as fire control chief became effective January 1. Kelly resigned to become executive secretary of the West Virginia Forest Council.

Frazier was made a district forest protector in 1947 and after four years in this job was assigned to the central office in Charleston as superintendent of construction on state forests.

Kelly first came with the commission in 1947 as district forester and in 1949 was promoted to the post of assistant state forester in charge of forest fire control. He is a graduate of West Virginia University School of Forestry.

Northwest Wood Products Clinic to be Held in April

The program for the Northwest Wood Products Clinic, to be held April 1 and 2 in the Davenport Hotel, Spokane, Wash., will include four panel discussions; (1) package handling of small logs, poles, pulp bolts, and cordwood; (2) debarking equipment and methods; (3) hardboard manufacture; and (4) reprocessing stock in saw and planing mills.

New Conservation Bulletin

Land of the Free, Conservation Bulletin 40 in the departmental series, tells the story of America's public lands.

In keeping with the theme of other bulletins in the conservation series, *Land of the Free* is designed to aid in the improvement of individual and community practices in the wise use and conservation of natural resources —particularly through understanding the management and conservation activities of the Bureau of Land Management. It bears the title of an earlier publication originally issued by the former General Land Office, one of BIM's predecessor agencies. The bulletin places more emphasis upon management and conservation — although retaining much of the historical material.

The new publication highlights the history of the public domain and the origins of the Bureau of Land Management. The 22-page, illustrated booklet also describes the major conservation objectives of the bureau and explains the provisions made by law for the use and acquisition of public lands and the forage, timber, mineral, and other resources on the lands.

Memorial to Robert Marshall

As a memorial to Bob Marshall, the chief founder of the wilderness preservation movement, the Autumn issue of *The Living Wilderness* calls special attention to his writings. It includes a posthumous article by him, "Impressions from the Wilderness," and an article by his brother George on "Robert Marshall as a Writer," with an extensive bibliography. A brief biographical sketch and fine photographs of Bob are included.

Bob Marshall was director of forestry in the Office of Indian Affairs from 1933 to 1937, and was chief of the Division of Recreation and Lands of the U. S. Forest Service from 1937 until his death in 1939. In the latter position he guided the establishment of the present system of wilderness areas within the national forests.

The Living Wilderness is published by The Wilderness Society, of which Bob Marshall was one of the founders. Complimentary copies of this memorial issue are available to friends of Bob Marshall. Requests should be addressed to The Wilderness Society, 1840 Mintwood Place, N. W., Washington 9, D. C.

Olin and Frost Industries to Consolidate

Olin Industries, Inc., East Alton, Ill., and Frost Lumber Industries, Inc., Shreveport, La., have agreed upon a plan to consolidate their businesses and properties.

Frost stockholders have been asked to approve an exchange of their company's assets for Olin capital stock. Frost Lumber Industries, with timberlands, sawmills, railroads, and oil and gas properties in Louisiana, Arkansas, and Texas, will continue operations under the present management as a division of Olin.

The acquisition will provide Olin with 450,000 acres of heavily forested land which is more than sufficient to support, on a perpetual yield basis, the nitrating and dissolving wood pulp mill which Olin plans to construct.

In announcing the plan, John M. Olin, president, stated that the consolidation "would give Olin Industries an assured source of pulpwood for the proposed pulp mill, which in turn would contribute to government requirements for nitrating pulp and provide raw material for Olin's future expansion in the cellophane industry."

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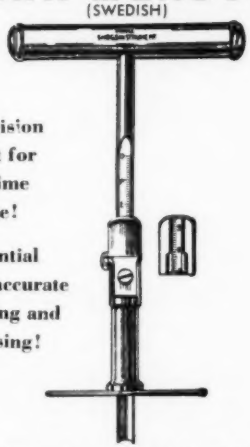

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Emphasis Placed on Site Studies

The Northeastern Forest Soils Group held its annual meeting at State College, Pa., on August 30 and 31, 1951.

The principal business of the meeting was a discussion of forest planting sites. A committee has been investigating the possibility of developing a better and more uniform method of classifying areas to be planted. Two outstanding facts were brought out by the committee's report:

(1) There is a serious deficiency in planting site knowledge available to guide tree planters in determining the best species to plant on a particular area. This could be called a lack of understanding of species requirements for successful planting. In spite of long experience in planting, we are still poorly informed when it comes to matching species requirements with site potential.

(2) The knowledge that has been compiled through research and by experience on species requirements and site analyses is neither well organized, adequately tested, nor uniformly available so that, in general, woefully poor application is made of it by tree planters—particularly amateurs and inexperienced professionals.

In view of this situation and mindful of the tremendous importance of the forest planting job faced in the United States, the group passed the following resolution to be addressed to conservation agencies in the Northeast.

The Northeastern Forest Soils Group recognizes that a great deficiency exists in planting site knowledge in the Northeast. It is the consensus of this group that this deficiency is due, in part at least, to the lack of emphasis placed on planting research; i.e. the study of species requirements and methods of site capability analysis. This organization wishes to go on record as urging that the conservation agencies in this region give greater consideration to this problem, and where at all possible, initiate studies in this field or concentrate more effort on existing studies.

Goodman Sustained Yield Reviewed by Conservation Group

The Wisconsin Conservation Commission recently spent a day studying the operations and property of the Goodman Lumber Co. at Goodman, Marinette County, where a supplying industrial forest is a permanent fixture.

The tour of the forest property was sponsored by the Wisconsin forest advisory committee. R. B. Goodman, head of the company, is a former chairman of the Conservation Commission. George A. Houghton, general manager of the Goodman Company, and Robert Martin and Jack Atkins, company foresters, explained the functioning of the company's forestry program and discussed the various factors involved in the plan of management.

The town of Goodman, dependent on the forest industry, continues to be a stable community where formerly "cut out and get out" policies dotted the map with ghost towns.

Masonite Increases Timberlands

Masonite Corporation's recent purchase of timber tracts of 15,000 acres from Standish & Hickey, Inc., marks the close of a 60-year period during which this firm played a dominant role in the timber industry of Mendocino County, California.

The purchase raised to some 70,000 acres the timber holdings of Masonite Corporation near its hardboard plant at Ukiah. The addition lies to the east and adjacent to Masonite's timber property purchased several years ago from the Southern Pacific Land Company and does much to integrate Masonite's properties. Standish and Hickey with their associates acquired the property between 1896 and 1930.

New Wood-Use Publications

Logging slash variations and an efficient method of salvage logging to portable mills are described in two circulars issued by the Washington Institute of Forest Products.

The circulars, written by John W. Allen, assistant director of the institute, are numbers 14 and 15 of the *New Wood-Use Series*. Circular number 14 describes variations that occur in size, grade, and volume of logging slash. Its objective is to take some of the guesswork out of relogging. Circular number 15 tells how loggers for the Baker-Gardner mills in Kitsap County are salvaging to portable sawmills in stunted old-growth timber that previous operators considered too small to pay its way. The logs are delivered to the mill at the rate of four cords per man per day.

Copies of the circulars may be obtained free of charge from the Institute of Forest Products, 303 Anderson Hall, University of Washington, Seattle.

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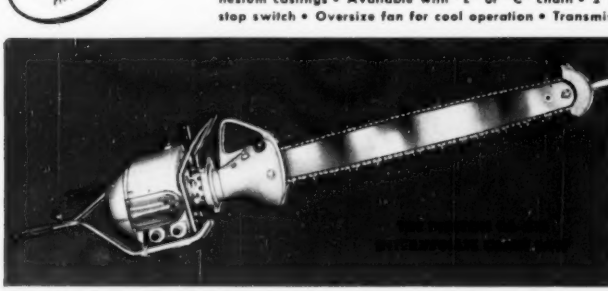

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